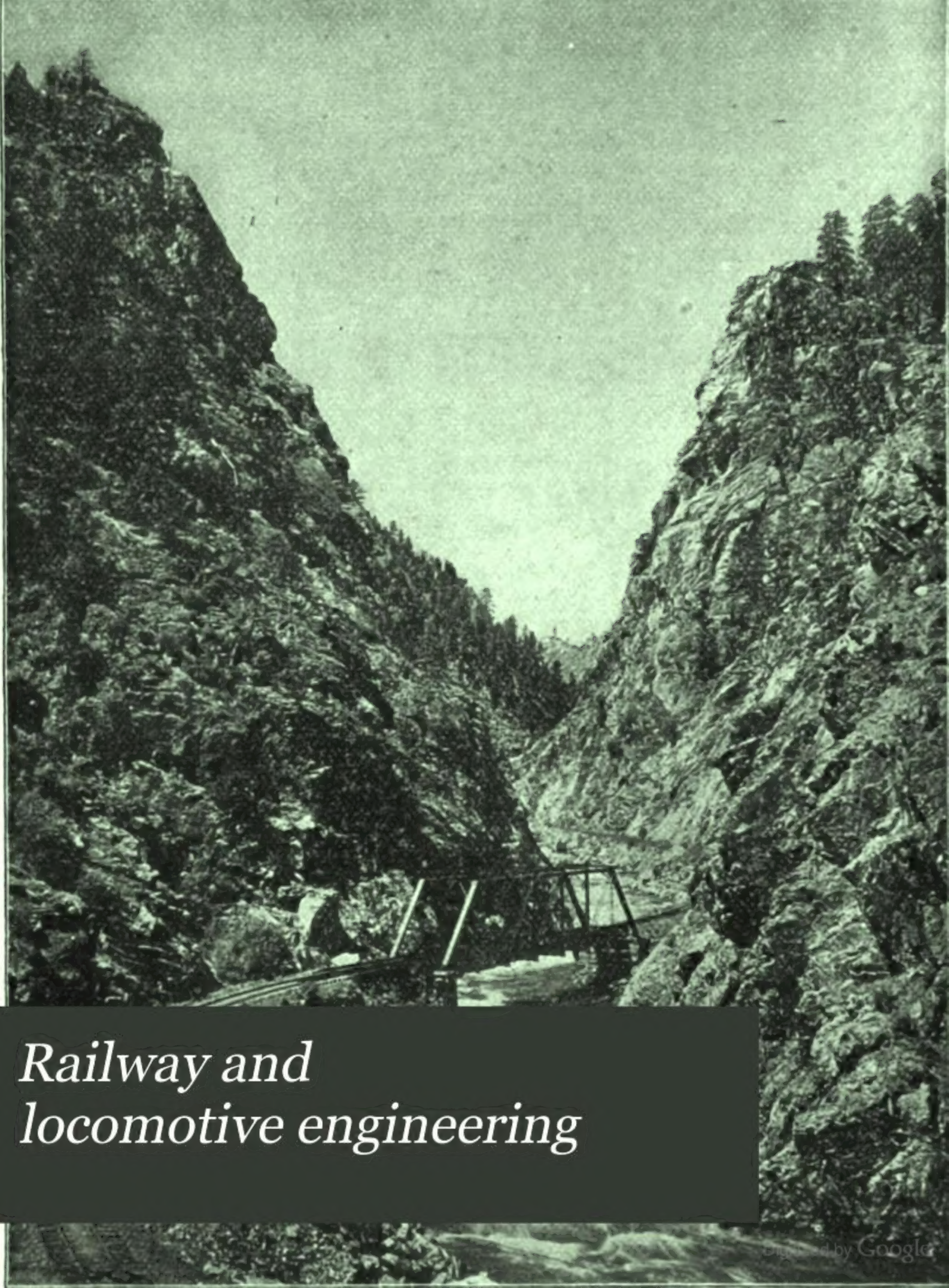

Railway and locomotive engineering

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LocomotiveEngineering

A Practical Journal of Railway Motive Power and Rolling Stock

95 Liberty Street, New York

January, 1899

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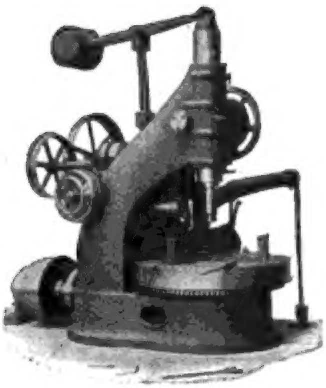

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Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XII 95 Liberty Street, New York, January, 1899 No. 1

Delaware, Lackawanna & Western Mogul.

The powerful-looking mogul hereby shown is one of a group recently built by the Cooke Locomotive Works for the Delaware, Lackawanna & Western. The engine diagram gives the leading particulars of this well-designed locomotive, which was the joint work of Mr. W. H. Lewis, master mechanic of the Delaware, Lackawanna & Western at Kingsland, N. J., and of the Cooke Locomotive Works. The tractive force of these engines is about 24,500 pounds, and the coefficient of adhesion close on 5.

COOKE MOGUL FOR DELAWARE, LACKAWANNA & WESTERN.

Seamless Tubes.

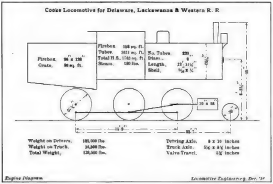
There appears to have been a growing tendency among some tubemakers to claim that their tubes were seamless when they had in fact been welded. A speaker at one of the meetings of the American Society of Mechanical Engineers said that whether a tube was seamed or seamless depended solely upon the tube itself, and not upon the process followed in its manufacture. Referring to the dictionary you will find that the word "seamless" means without seam, which conveys no light upon the subject. Turning to the word "seam," it is found that it is defined as a joint, suture, or line of union, and here in the last term we find the key. A tube jointed in any way cannot be seamless. If, in the primary stages of its manufacture, it be lap, butt or lock-jointed, it cannot by any subsequent operation be deprived of the seam, and therefore cannot be considered, when completed, as being seamless.

A strictly seamless tube may be made by any one of three operations. First, a billet may be, by successive steps, punched into the form of a tube with extremely thick sides; and these may then, by the ordinary drawing processes, be reduced to a tube with thin walls. Next, the billet may be bored, or the blank may be cast with a hole in it, and in either case then drawn to the required dimensions. Thirdly, the tube may be made by the cupping process, which consists in taking a disk of the metal, forming it into a cup shape, gradually elongating the cup and reducing it in diameter, and finally by this means producing a tube. Each and all of these processes yield a tube which is absolutely seamless and about which there is and can be no dispute. In all tubes formed with a seam the edges have first been separated, then united, either by lap or butt weld, or by some lock-joint system, and in these the joint cannot be eliminated by any after process.

The Custom House of the United States recognizes the difference between a seam and a seamless tube. A seamless tube is one in which the walls have never been separated from the time the metal was in a molten condition to the time of the completion of the tube.

Opening of Purdue Lecture Course.

The first lecture of the Purdue Railway Course for the season of 1898-9 was given on November 29th, by Dr. Charles B. Dudley, Chief Chemist of the Pennsylvania Railroad. Dr. Dudley's subject was "The Relation of Chemistry to the Railroad." The speaker first gave some interesting figures on the amounts of money spent by the railroads for various materials, which very forcibly illustrated the immense importance of the departments of chemical and physical testing and inspection. He said that the purchasing agent of the Pennsylvania Railroad spends from $17,000,000 to $20,000,000 a year, and of that amount about $5,000 goes for rubber bands, $7,000 for lead pencils, $1,000 for pins, $5,000 for ink,



$2,000 for toilet soap, $1,000,000 for lumber, $60,000 for hose, and called attention to the very interesting fact that it costs nearly as much for stationery with which to carry on the business of the road as it does for iron. The duties and responsibilities of the inspector were then described and his work illustrated by reference to numerous actual cases.

Dr. Dudley took up the subject of specifications and showed how they are built up and the methods of obtaining the information from which they are compiled. As an illustration he gave in detail the Pennsylvania Railroad specification for car axles. These specifications contain not only information for the guidance of the manufacturer but as well for the purchasing agent, inspector and tester.

He showed that it was the duty of the chemist not only to write specifications and test materials but to investigate special problems on a great variety of subjects, and related many instances from his own broad experience which showed the wide range of information and ingenious application of new methods which have been called into play in the solution of these various problems which have arisen from time to time. The charming personality of the speaker and his wide experience combined to make the address one of unusual interest and profit.

The Roundhouse Erecting Shop.

The utilization of a roundhouse for erecting purposes, either for locomotives or cars, when for reasons of a change in policy in rolling stock management it may become necessary to separate the shops of the two departments, is quite a common occurrence in the last few years, and no longer arouses that feeling of prejudice against the move, so prevalent at first, for the reason that men have learned that there are some other things to be considered besides the contour of enclosing walls. We have seen roundhouses that embodied the best points of an ideal erecting shop, namely, plenty of room and light, and a favorable location with reference to all other shops of the plant. There are some advantages in the way of drop pits and cranes, in their adaptation to a roundhouse, that are not usually obtainable in the regulation combined machine and erecting shop, unless installed when built, and the latter is an exception in the older plants. In the matter of ventilation, the roundhouse is easily and satisfactorily controlled by reason of the smoke jacks, and a comfortable temperature is always available when steam-heated. The car-erecting shop of the Canadian Pacific at Montreal, and the locomotive-erecting shop of the Baltimore & Ohio at Norwalk, Ohio, are good examples of such shops for reference.

If any railroad company is in want of competent locomotive engineers, we could supply some good men. We are prepared to vouch for their efficiency.

SCENES ON A COLORADO MOUNTAIN RAILROAD.

TRESTLE ON COLORADO MIDLAND, NEAR HAGERMAN TUNNEL.

Locomotive Efficiency.

(Third Paper.)

BY C. A. SELEY.

The engineer who undertakes the redesigning of a back number locomotive will do well to make a very thorough preliminary survey, covering grate and heating surface, actual weight in running condition on each driver and the truck, sizes of axles, journals and pins and the general design of the frames. A study of these figures together with the tractive power will give a basis upon which to form conclusions as to what radical, and consequently expensive, changes may be necessary. For instance, if the amount of weight available for adhesion and the grate surface are not adequate, a new boiler will be necessary for best results. If the percentage of traction (found by dividing the tractive power by the weight on drivers) is over .28, then additional weight should be provided, or the tractive power reduced by reduction of pressure or increase in size of wheels.

With a good boiler and a traction percentage of .25 or less, we have a very hopeful case, and it then remains to calculate the strength of pins, axles and frames and to fully investigate the steam passages and valve motion for possible improvement.

In making changes, care should be taken to conform to standards of the road in matters of detail when consistent with good practice, and to work towards a reduction of patterns. It is of course impossible in an article of this kind to lay out a plan of procedure for redesigning to be of general value, as locomotives vary so greatly in the details, according to the ideas of those specifying them and the changes they undergo in years of service and numerous repairs.

There is, however, one branch of the work that may be of interest to follow out in detail, and which might be looked into when a general redesigning is not intended. The efficiency of a locomotive so largely depends upon the design and adjustments of the link motion, that a thorough knowledge of its action in these particular cases is very desirable. But few roads are particular enough in this respect to run their valves over and ascertain their action in the running notches, what lead they are getting in 6 or 8-inch cut-off, how the cut-offs are equalized, and if similar work be done in the cylinders. The difficulty of acquiring this knowledge quickly, accurately and without some little expense and inconvenience is generally a sufficient reason for passing it over and trusting that it is nearly as good as our neighbor's. In many cases all the shop information is in the link man's head and his templets and dirty little book. I am speaking now more particularly of the older engines, for which many present-day officials are not responsible. Locomotives are generally longer lived than officials, and drafting rooms and blueprints were less common in former years. It is expensive and inconvenient to run over the valves of many types of engines, occupying much time and room that in many shops can illy be spared. Following will be found methods by which link motion can be investigated and accurate data deduced, whether for purposes of redesigning or merely for studying a well-known good motion. It is proposed to explain how to do this by a model constructed specially for each class of engine to be investigated.

In order to accurately derive the crank positions for different piston positions and cut-offs, a large circle divided into degrees will be needed. A very good one, about 13 inches diameter, printed on heavy Bristol board, can be procured from the stationers in engineers' supplies. This should be divided into quadrants, and a small circle denoting the crank position drawn at one of the quarters. Circles of a diameter equal to the full throw of all the eccentrics to be investigated should be struck from the center; 5, 5¼, 5½, 5¾ and 6 inches will generally cover this requirement. The sheet should then be mounted on a circular board about ½-inch thick, made up so as not to warp, and a hole made in the center and countersunk so as to fit a large screw on which it will be rotated. The center of this disk is to represent the center of the axle, and for the eccentric centers adjustable plates should be placed in curved ways fastened

CAMEO ROCK.

to the disk, so that a center corresponding to any throw can be slid around on the circle and constantly coincide with it, thus producing the same effect as throwing the eccentric around on the axle. Small holes are made in this sliding piece over each eccentric circle, and the guides or ways arranged so as to clamp the slide in any position required for angular advance. A large board should be used, and on it should be laid out accurately the several centers of the axle, rocker box and lifting shaft stand in full scale, and the center line of motion drawn through the axle and tangent with the path of the lower rocker arm center. The disk previously described should be secured at the axle with a well-fitting screw. For the rocker use a piece of oak or other stiff wood, 4 x ½ inch and about 8 inches longer than the combined length of the rocker arms. Draw a center line upon it and mark the centers of the rocker box and of the pins, leaving the extra length at the bottom end. A hole for a well-fitting countersunk head screw should be put through the point denoting the rocker box center. A small stud projecting ½ inch should be put in the lower rocker arm center, and then the rocker is ready to screw to the board in its proper position. The link is made from a board 6 x ½ inch, about as long as the full-size link. On this the link arc should be scribed to the proper radius and the link pins located. The link arc may then be sawed out with a fine saw and finished with a file to a convenient width—say, ¼ inch—and a small link block fitted that will have a hole for the stud in the lower end of rocker arm.

A SMALL CANON IN THE ROCKIES.

It will be noted that the extra length of the rocker arm below the stud is to support and steady the link which lays directly upon it, entirely loose, except for the link block pin.

The eccentric rods may be of wood, and 1 x ⅝ inch will be found stiff enough. For convenience, these may have a lap sliding joint in the middle for length adjustment. They have a stud in the eccentric end to fit the holes in the slide pieces, which represent the eccentric centers. The stud in one rod should be ½ inch longer than the other, to obviate the difficulty of the rods interfering with each other, and in this way almost a complete revolution can be made. When necessary, the long-studded rod can be lifted until its center has passed from under the other rod, when it can be replaced and the revolution continued. It will be found that this difficulty does not occur at a critical point in the revolution. The link ends of the rods should be screwed to the link at the proper centers, and if the ends of the rods extend beyond the screws about 2 inches, it will serve to further steady the link. Link saddle pins are, as a rule, set back from the link arc, and an adjustable piece bearing a small stud may be secured to the link. This must be ½ inch high, so that the hanger will not interfere with the top eccentric rod. A piece of oak, 2 x ½ inch, will make a lifting shaft arm, and another of same size the link hanger; the lower end of link hanger to have a hole to fit the stud in link saddle, and the upper end to screw to lifting shaft arm. It is understood that these are of the proper length between centers corresponding to the actual dimensions on the engine. The inner end of the lifting shaft arm should be blocked up to a hight to make all connections level, and to be secured to the point corresponding to the center of the lifting shaft stand. This arm may have any convenient form of clamp to hold it in required positions. It now remains to make a valve rod attached to upper center of rocker and connected to a cardboard valve, guided by slots and pins over a valve seat. These may be placed for convenience over the disk instead of forward of the motion, to enable the observer to turn the disk and watch the valve movements at the same time.

If sufficient care has been taken in measurements and workmanship, we now have the means of exactly duplicating the action of a link motion in any position of the lever. All screws should be just loose enough to permit easy motion without slack, and the model is ready for use. Further refinements may be used, and some of the parts described may be made in iron for permanent use, but personal experience with a motion such as described, has found it to give excellent results.

Now from the tables of crank angles that may be found in many hand-books or works on valve motion, select the one which represents the relation of the length of the main rod and crank of the engine to be investigated and have it at hand.

Draw off in a note-book a page giving the following items: Class of engine; number of engine measured, or number of drawing consulted; throw of eccentric; radius of link; link pin centers; link pin centers from link arc; length of link hanger; length of lifting shaft arm; offset

of link saddle pin; length of upper arm rock shaft; length of lower arm rock shaft; back set of lower arm rock shaft; chord of lifting shaft arm when lever is thrown from corner to corner of quadrant; outside lap of valve; inside lap of valve; lead in full gear; width of steam port; width of exhaust port; width of bridges. It might be said that these notes should properly be taken before making the model, as all the figures will be needed in the construction, but they should be recorded for after reference. On the opposite page rule columns for the data as observed, noting: Reverse lever positions; measured lead; port opening; slip of link block; crank degree at opening; crank degree at closing; crank degree at exhaust opening; crank degree at exhaust closing; and any other items that suggest themselves. It is always interesting to know what has been done, whatever the errors may be, and for this reason it would be advisable to set the valves exactly as has been customary and get full information before altering any of the setting.

The crank may be placed on the centers, the rods adjusted and the valves set in the ordinary way. The full-gear data should be taken for both forward and back motion. The crank angle table should then be consulted for one-third or one-fourth cut-off angles and the link raised until the cut-off is shown by the valve when the crank is at the correct degree. Full data should then be taken, as before. The link may then be raised to the center for further data. We can now deduce the inches in the stroke at which the events occur. If too great lead is found in the running notches, it should be reduced to the proper amount and the consequent full-gear lead ascertained. If the cut-offs do not equalize well, it is probable that the hanger pin offset is not correct, and the suspension can be changed by altering the adjustable hanger pin until trial has demonstrated its correct position. If the radius is wrong, unequal lead or cut-offs will be plainly shown, and the possibilities of a link of correct proportions can be demonstrated.

Doubtless many of the locomotive builders have models which might shame the crudities of the one here described, but few have access to them, and for the earnest seeker after knowledge in this particular line, who wishes to see with his own eyes the action of link motion, this model is available, costing, as it does, but a little careful work and inexpensive material. There are many excellent treatises on the subject, but they are frequently discouraging to the average reader, who finds difficulty in following diagrams that are so clear to the mathematician, but Greek to him. After constructing and using a model of some good motion, however, the books will then seem easier, and better progress can be made. A little courage and perseverance will overcome the difficulties that seem discouraging at first.

The Westinghouse Machine Company, with offices and works at East Pittsburgh, have received contracts for what will probably be the largest turbine engines in the world. This order consists of three turbine engines of 500 horse-power capacity each, to drive generators and Tesla motors to be furnished by the Westinghouse Electric & Manufacturing Company, for the replacement of a large number of steam engines at present used to drive the machinery of the air-brake company at Wilmerding. The machine company are also constructing, under a rush order, a Parsons turbine engine, the first of five of 2,500 horse-power each, to drive a 1,500-kilowatt multiphase generator for use by the United Electric Light & Power Company, of New York City, which company will install it on a block of land adjacent to their new station, on Twenty-eighth street and East River.

SEVEN CASTLE ROCKS.

A MEETING POINT.

Rules About Firing.

The following instructions have been issued for the guidance of enginemen and firemen on the Baltimore & Ohio, in order to secure a more economical firing of locomotives and an abatement of the smoke nuisance:

Coal is composed of carbon, gaseous matter and ash. Carbon forms the solid portion of coal, or that part which, after the gaseous matter has been expelled by heat, remains upon the grate as coke until finally consumed together with the impurities forming the ash, the gaseous matter forming the smoke. The gaseous matter, if mixed with sufficient air, will burn and generate heat; if not, it will pass out unconsumed as black smoke, causing a waste and creating a nuisance.

Formation of smoke can be largely prevented by careful firing. One shovelful of coal at a time scattered over the firebox, a reduction in temperature ensues until the gas is expelled from the coal. To make this as small as possible, light fires should be carried to insure high temperature. Large nozzles should also be used to insure the least disturbance to fire.

Engines should not be allowed to pop off, as it is wasteful, and can be prevented by applying injector or closing ash-pan dampers.

Firemen should see that the ash-pan, dampers and rigging are in order, and that they have a bright fire before leaving roundhouse; also that they have sufficient fuel on the fire to hold it and keep up steam while engine is starting train, avoiding, as far as possible, opening the firebox door while exhaust is strong.

Firemen on freight trains should be especially careful in firing on approaching tunnels and stations, and when practicable, firing should cease entirely at such points.

A ROTARY SNOW PLOW AT WORK.

fire, with door left partly open a few seconds to admit air to mix with the gases released from the green coal, will cause the smoke to be consumed. Care should be exercised to have the door open no longer time than is necessary, as the admission of large volumes of air will lower the temperature in the firebox, with the consequent injury to the flue sheet and flues.

The practice of charging several shovelfuls of coal at a time should be avoided and frequent firing practiced, as in the former case large quantities of gas are liberated at once, with no chance of mixing with sufficient quantities of fresh air to insure perfect combustion, and the temperature of the firebox is lowered. Large lumps of coal should be broken into small ones before being charged into the firebox.

When green coal is charged into the

Water should be fed into the boiler regularly by the engineman, thereby enabling the fireman to fire regularly and economically.

Enginemen and firemen on passenger trains must observe the following additional instructions: When approaching a station where a stop is to be made, or descending a grade, no smoke must be allowed to show at stack, the blower should be applied and furnace door partly opened, and both so regulated as to prevent the formation of smoke. On approaching tunnels, fires must be sufficiently replenished beforehand to avoid firing through tunnels and the consequent formation of smoke, the furnace door being closed while passing through tunnel. The drumming noise made by locomotives should be prevented at stations; this is accomplished by admitting air to firebox.

Chicken Cars in a Wreck.

The veteran freight conductor was talking about wrecks, damage suits and other trials and tribulations that the big railroad companies are exposed to, and the subject drifted to the woes of the farmers who must watch their fences burn up, see their stock killed, and seldom have any chance to recover damages. "There was one farmer out along our line," he said, "who got even through an accident. This man had a great many chickens, and when they wandered out on the tracks to pick up grain that had leaked from the cars, many of them were run down and killed by the fast trains. The owner kicked, complained and prayed, and once he actually brought suit against the company, but lost his case and had to pay the costs. This was galling to him, but one day he had his inning, and at the same time had his chicken population increased to the extent of 1,500 fine fowls. You see, we had five cars full of live poultry on the train, and as they were the new-style poultry cars, each one of them contained more than 400 fine fowls. The long train was going down hill past this farmer's place, when an axle on the car just in front of the poultry gave way, and in an instant the whole train was piled up higher than the telegraph poles. You ought to have seen it rain live hens and roosters when those cars were ripped to pieces. They came down like wild ducks and flew off to the fields, some of them on wings, and others trusting to leg-power. In an instant that farm was overrun by the strange pullets and chanticleers. Many of them had been killed, but at least 1,500 of them took refuge on the farm alive and well, and were soon mixed up with the native fowls. The company officials wanted to send men on the farm to catch the escaped chickens, but the farmer came out and declared he would sue for trespass, and that if one of his hens was taken he would make the company pay dear for it.

"The officers of the road were puzzled, and consulted the general counsel, and that gentleman, after due reflection, said it would be absolutely impossible to separate the railroad chickens from the farmer's fowls, or to obtain an accurate list of the number of chickens lost, and that the safest way was to pay the owner for the entire cargo and say no more about it.

"The old farmer was happy, and declared that he was doubly in luck, as the fowls that came from the wreck were so badly scared that they would not go near the tracks, and he lost none of them in that way. He had to build a big addition to his hennery, and in recognition of the fact that it was my crew that had charge of the train that brought the windfall, he always presented us with five fine fat hens the day before Thanksgiving."—*Pittsburg Post.*

Criminal Wheel Fitting.

From *Transport* we learn of the derailment of a passenger train on the Great Western Railway, due to the shifting 1½ inches outwardly of one of the truck wheels under a coach. On investigating the case at the shops, the defective wheel was pulled off with a force of 10 tons, and it also took a force of 10 tons to put the wheel back to its gage position on the axle. This was plainly a flagrant case of bad fitting, since the hub was found perfectly sound; but the man who pressed those wheels on originally had an entry of 70 tons pressure recorded against the wheel that moved.

There can be no doubt that the record is a false one and made to screen the man who made the misfit, for it is well known that it requires a force to start a wheel off its seat always equal to and many times far in excess of that to put it in place.

To guard against the "personal equation" in recording the pressures in fitting wheels to axles, Mr. Williams, the mechanical superintendent of the "Soo" road, some years ago devised an automatic recording device something on the principle of an indicator diagram. The wheel press man is simply powerless to manipulate such a record. In view of the disastrous results likely to follow the dishonest or careless fitting of wheels and axles, we believe the automatic record of pressures should be a part of every wheel press.

Peter Cooper's Engine.

One of the interesting bits of railroad history is that of the trial of the "Tom Thumb," built by Peter Cooper in 1830. This was really an era in the railroad world, for it meant the adoption of steam power by the Baltimore & Ohio Railroad, and made possible its extension and growth into one of the first large railroads of America.

Few believed that locomotives could turn sharp curves or climb grades of any account, and yet this little engine of about 1 ton and of very small power, drew 4½ tons over twelve miles an hour from Baltimore to Ellicott's Mills.

This locomotive had a vertical multitubular boiler, Winans' patent; one vertical cylinder, double acting, 3¼ by 14 inches; a train of gears connecting the crank shaft and axles (one account says rope gearing); and a blower for creating draft, driven from axle. It is said to have had the valves driven by eccentrics, with V-hooks for a reverse motion. Even Ross Winans was so impressed with the performance of the "Tom Thumb," that he declared it surpassed Stephenson's "Rocket" in actual performance, as the latter weighed six times as much and had a perfectly straight and level track to work on.

A Frame Stiffener.

Superintendent Wightman, of the Pittsburgh Locomotive Works, has patented a frame casting for strengthening the front frames of a locomotive. The casting fills the space between the frames and extends from the bumper beam to the saddle. It is light, but ribbed so as to offer the greatest resistance to the working of the cylinders, and thus prevent breakage of bolts through frames and saddle. Such a casting should be a fruitful preventive of frame distortion in case of collision, and we believe that rigidity carried with it cannot but be of advantage in all cases where it is used, but more especially on the frames of locomotives, without the proper stiffening at the rear, as in case of six and eight-wheel connected engines.

The high cylinder saddles now in use put tremendous strains on the frames, to which Wightman invention will offer good resistance.

A PARTY OF PLEASURE IN THE MOUNTAINS.

Crandall's Bell Ringer.

A bell-ringer designed by Mr. Crandall, foreman of the Hannibal & St. Jo shop at St. Joseph, Mo., as shown in our illustration, has been in use for some time on the above system, and is well liked by all who have used it. Like most of these devices, this one is secured to the bell frame, as shown in Fig. 1. The piston is shown down in Fig. 2, ready to receive air or steam (it may be operated by either) through the admission port, which raises the piston, and through its connection with the crank arm on the bell shaft, rings the bell. Fig. 3 shows the piston raised and about to descend by gravity after the air is exhausted. The admission and exhaust ports are shown above Figs. 2 and 3, in their respective positions for the position of pistons to which they refer. The piston is caused to have a spiral motion as it rises and falls in the cylinder, by means of a set screw in the side of the cylinder, which engages with a groove in the piston; the groove is shown in Fig. 4, the set screw following edge of the groove. This spiral action of the piston moves it in the cylinder so as to uncover the admission and exhaust ports alternately.

Fig. 2.

Fig. 3.

Fig. 4.

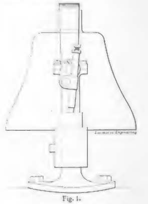


Fig. 1.

Railroad Men in Politics.

It is reported that at last election railroad employes voted very largely for those who were known to be friendly to railroad interests, and against the class of politicians who think that political capital can be made more easily out of abusing railroad companies than through any other course.

The *Pittsburg Post*, noting the new political attitude of railroad men, says: "A railway official who has been studying the situation carefully said yesterday that he was 'amazed at the present political attitude of the men, and that it meant more than most people were aware of. These men,' he said, 'have a twofold object in view. In the first place they propose to fight adverse railway rules and regulations with legislation as well as organization, and in the second place they promise to protect the railroad companies from the more radical elements which are working tooth and nail for reduced rates in different States. We found the men on our side in Ohio when the Legislature was about to strike a blow at the railways of that State. While the new amalgamation of forces is likely to impose upon every railway company the necessity of increasing wages, yet we ought to, and I think every level-headed railway manager in the country will admit that it would be wiser to grant the increase and obtain the political support of the men than to refuse and be compelled to submit in the end, and show a disposition that might tend to give the men the idea that the railroad managers have no souls and must be forced into everything of a nature favorable to their employes.'"

Catskill Mountain Railway.

The accompanying photograph illustrates engine No. 4 built by the Schenectady Locomotive Works for the Catskill Mountain Railway, a narrow-gage (3-foot) road about 16 miles long, which passes through some very picturesque scenery on its winding way from Catskill Landing, on the Hudson River, to the base of the Catskill Mountains. At Otis Junction it connects with the Otis Elevating Railway, which was illustrated and described in LOCOMOTIVE ENGINEERING in November, 1893, and which by means of cable power propels its cars up 7,000 feet of incline, in which distance it ascends 1,600 feet; and the Catskill Mountain train, having ascended 600 feet in its journey, the traveler, on reaching the summit, finds himself 2,200 feet above the Hudson River, with a magnificent panorama of the valley unfolded before him. He is also within 300 feet of the famous Catskill Mountain House, which, by the way, has just passed through its seventy-sixth season. The locomotive, it will be noted, carries the name of Mr. Charles L. Beach. This gentleman and his two sons are owners and proprietors of the Mountain House and are also largely interested in the railroad.

A glance at the illustration will suffice to show that No. 4 is a modern locomotive and up-to-date even to a steam bell-ringer. The vacuum brake, however, is used instead of the air brake. This, of course, prevents the use of the conductor's whistle signal on the engine, there being no air to operate it with. In the front of most locomotive cabs there are usually two small sliding windows, while in this one it will be noticed there is only one sash, swung on hinges at the top and opening outward, making it possible to have a circulation of air through the cab in stormy weather without the rain beating in. The writer understands that the window was so constructed from a suggestion made by Mr. John A. Hill, formerly of LOCOMOTIVE ENGINEERING, in an article written by him touching on improvements to locomotive cabs for the comfort and convenience of the enginemen.

The photograph was obtained through the courtesy of Mr. John L. Driscoll, master mechanic and road master of the Catskill Mountain and the Otis Elevating Railways, who had the engine placed in position for the purpose, and who has kindly furnished a few leading particulars in regard to it, which are as follows, viz.:

Total weight of engine in working order—56,100 pounds.

Total weight on driving wheels—36,000 pounds.

Wheel-base, driving—6 feet 9 inches.

Wheel-base, total of engine—18 feet 5 inches.

Wheel-base, total of engine and tender —40 feet 6 inches.

Diameter of cylinders—13 inches.

Stroke of piston—18 inches.

Diameter of driving wheels—49 inches.

Diameter of driving journal—6 inches; length, 7 inches.

Diameter of truck wheels—24 inches.

Boiler, working pressure per square inch—160 pounds.

Boiler, diameter of front end—42 inches.

Length of firebox—90 inches.

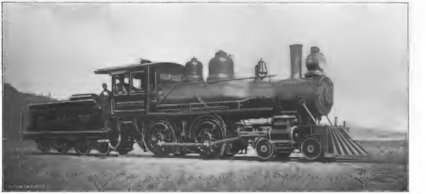
Width of firebox—24½ inches.

Number of tubes—120.

Outside diameter—2 inches.

Length of tubes—9 feet 5½ inches.

Fuel used—Anthracite coal.



CATSKILL MOUNTAIN LOCOMOTIVE.

To Relieve Injectors of Scale.

As is well known to those who are obliged to use soda-ash for a scale solvent in locomotive boilers, the effect of the remedy on injectors is to rapidly clog the tubes by a baking-on process, which, if not removed, soon renders the instrument of little avail as a boiler feeder. Numerous ways of removing this hard scale have been resorted to, but none are as successful as that devised by General Foreman Lyddon, of the Northern Pacific shops at Brainerd, Minn. The idea was to use an agent that would attack this scale with the same efficiency as the soda-ash had shown in the boilers, and experiments with muriatic acid gave results that were satisfactory in all respects, not only with the injectors, but all other parts liable to incrustation. The bath consists of an old oil barrel, into which is placed a large earthenware jar which contains the acid. Parts to be treated are allowed to remain a short time in the acid, and are then dipped in clear water, after which all vestige of scale has disappeared down to clean metal.

A paper was read at the last meeting of the American Society of Mechanical Engineers on "The Calorific Power of Weathered Coal," which ought to be of considerable interest to railroad companies and other power-users who have large quantities of coal constantly exposed to the weather. Very careful tests were made to ascertain the effect of exposure to wind and weather for eleven months. It was found that the action of the weather decreased the percentage of carbon, hydrogen and nitrogen, while it increased the quantity of oxygen. The heat value of the coal was decreased about one-half of one per cent.

Roundhouse Lighting.

It might be more proper to speak of roundhouse darkness, as that is too often the condition, and a recent visit to one of the main roundhouses of a large road revealed the use of the smoky, odorous torch which only made the darkness more intense. The cost of repair work under such conditions (to say nothing of its quality) would soon pay for a lighting system with arc lamps for general lighting and portable incandescent lamps for special work.

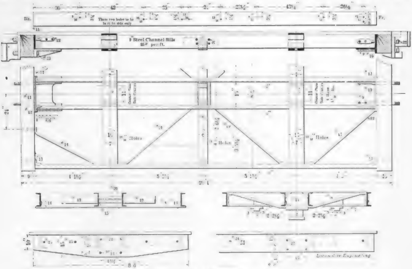
The amount of work that can be done by the flickering light of a torch is not large nor of the best grade. Even though night work may not be desirable, it is still necessary many times, and at least one or two tracks should be provided with proper light for this purpose. They might be called "night-work" tracks and saved for engines needing rush repairs.

Steel Tender Frame—Chicago Great Western Railway.

Now that steel car framing has passed the nursing-bottle period and arrived at a stage of development easily fostered because of its security, there is a revival of interest in the steel tender frame. Just why this type of frame should ever be allowed to languish is one of those peculiar things no fellow has been able to explain satisfactorily to its advocates. An examination of the accompanying design of the Chicago Great Western will not reveal any very serious weaknesses on which to base an objection. In fact, it will be seen to be a strong frame for the material in it, and so simple in its structural features as to be cheaply built and maintained.

The longitudinal sills are steel channels, while the end sills are of oak. The bolsters are bolsters in fact, and not merely fillers, and to their integrity as sustaining members may be ascribed the reason why the frame is not subject to deformation under load; it holds up. The diagonal bracing has the same office in resisting the horizontal forces. The accompanying bill of material gives all necessary particulars of the details entering the construction of the frame, for which we are indebted to Mechanical Engineer Seley.

If any of our contributors fails to find his article in this or the next few issues, he is requested to send us a duplicate copy of it, as, with few exceptions, all "copy" was destroyed. The fire occurred so early in the month that but little of it had been sent to the printer. Send 'em along early and often. We are particularly short of correspondents' letters.



STEEL TENDER FRAME, CHICAGO GREAT WESTERN.

BILL OF MATERIAL.

No.	Name	No. Pces	Dimensions	Weight
			25 lbs. per ft.	lbs.
1	Right center sill	1	9" channel, 18' 7" long	1,867
2	Left " "	1	9" " 18' 7" "	
3	Right side "	1	9" " 18' 9" "	
4	Left " "	1	9" " 18' 9" "	
5	Transom, top bar	2	¾" x 10" x 8' 4"	446
6	" bottom bar	2	1¼" x 10" x 7' 9"	659
7	Side bearings bar	4	¾" x 10" x 2' 10"	289
8	Center tie bar	1	¾" x 6" x 8' 1"	127
9	Front tie plate	1	¾" x 12" x 1' 9"	45
10	" end "	1	1" x 12" x 8'	82
11	Back " "	1	1" x 9" x 2'	62
12	Corner irons, end plates to center sills	4	3½" x 3½" angle 7" long	24
13	" end timbers to side sills	4	3½" x 3½" " 9" "	41
14	" transoms to center sills	8	3½" x 3½" " 10" "	91
15	" tie bar to center sills	2	3½" x 5" " 6" "	17
16	" tie bar to side sills	2	3½" x 3½" " 6" "	14
17	Front corner braces	2	1" x 5" x 5' 1"	73
18	Back " "	2	1" x 5" x 4' 7"	145
19	Middle " "	4	1" x 5" x 5' 10"	197
20	Center brace thimbles	4	1¼" x strong pipe 15" long	815
21	" bolts	4	1" x 19½" square head and nuts	28
22	End casting "	2 4	1¼" x 15" 1¼" x 16" } with 3" x 1¼" x 11" shank	115
23	" "	2	1¼" x 16" square head	22
24	Front timber "	2	1¼" x 13½" "	15
25	Back " "	4	1¼" x 12½" "	27
26	Bolts for No. 22	12	1¼" x 4½" "	65

Two New Rogers Locomotives.

The engines on this page and on page 12 fairly represent the ten-wheel type of engine for both freight and passenger service. The Texas & Pacific engine is lighter by about 8,000 pounds than the freight engine of the Illinois Central, and this proportion is apparently maintained throughout. The principal dimensions are as follows:

Cylinder—19 x 26 inches.

Cast-steel drivers—67 inches in diameter.

Driving wheel-base—13 feet.

Total wheel-base—24 feet.

Weight on truck—41,500 pounds.

Weight on drivers—115,000 pounds.

Total weight—156,500 pounds.

Boiler, diameter—62 inches.

Tubes—2 inches diameter, 13 feet 9 inches long.

Number—285; iron.

Tube heating surface—2,051.7 square feet.

Firebox heating surface—140.9 square feet.

Total heating surface—2,192.6 square feet.

Grate—42 x 106⅛ inches, 30.95 square feet.

Steam pressure—190 pounds.

Tender capacity—4,300 gallons.

It is equipped with two No. 3 Coale muffler safety valves, Nathan lubricator, two monitor injectors, Westinghouse American brake on all wheels, United States metallic packing, Gould pilot, Golmar bell-ringer, Krupp tires, Houston sander.

The principal dimensions of the engine for the Illinois Central are shown on the engine diagram on page 17. As will be seen, it has an extended wagon-top boiler. This is 66 inches in diameter and made of ⅝-inch steel. The tender holds 5,000 gallons.

The equipment consists of two No. 3 Ashton muffled safety valves, a Nathan lubricator, two Nathan injectors, Krupp tires, Westinghouse-American brakes, United States metallic packing, Leach's sander, Heginbottom bell-ringer, Safety Car Heating & Lighting Company's steam-heat apparatus.

Committee on Flanged Tires.

Since touching on the wide difference in the location of plain tires on engines having six or more wheels connected, we are in receipt of a circular from a committee of the Master Mechanics' Association, seeking information that is intended to expose all the weaknesses of the diverse situation as it stands at present. The questions asked refer to the location of flanged tires on mogul, ten-wheel and consolidation engines, as follows: Length of wheel-base, rigid and total. Is engine truck rigid or swing motion, and what is side motion, if any? How much lateral motion between driving box and hub on engine leaving the shop? How much lateral motion between truck box and hub when engine leaves the shop? Distance between flanges? Degrees in sharpest curve on the line? Is track laid wide of gage on curves; if so, how much for each degree? Has present practice in location of flanged tires ever caused any trouble, and in what way? What are the benefits or advantages resulting from present practice?

If there is a proper disposition manifested to answer these questions, there is no doubt that this committee will be able to give the association some interesting facts. They are remarkably well equipped with inside personal information on this subject, that must of necessity be of the greatest value in formulating their report; but they are entitled to the information asked for in order to make it what it ought to be, in showing the exact status of tire location.

Some of these questions will be grudgingly answered, no doubt, if at all for they are calculated to bring out all weak points.

China on the Move.

There has been more talk than real work on Chinese railway construction; but one line, the Imperial Chinese Railway, has made considerable progress. This railway is without doubt one of the greatest enterprises in northern China. Already 320 miles of road have been constructed (80 miles of which are double track), and 125 are now under construction. The company has sixty-four engines of Chinese make, four Belgian, twenty-one American and thirty-eight English. From 8,000 to 12,000 men are constantly employed, forty-two of whom are foreigners. They have extensive shops at Tong Shan, where cars of all kinds are built. The cross-ties and bridge timbers are imported, principally from Oregon, although small shipments, far inferior in quality, are received from Japan. The road is gradually being extended, and ere long will be completed to Niuchwang, one of the terminal points of the Russian Railway. The traffic for the past eleven months was as follows: Passengers carried, 1,216,885; freight, 1,870,118 tons. The traffic is rapidly increasing, and already the road is paying handsome dividends. Those most familiar with Chinese railways advise American railroad men to keep away from them.

ROGERS TEN-WHEELER FOR TEXAS & PACIFIC.

A patent has been granted to Mr. T. A. Browne, master mechanic of the Juniata shops of the Pennsylvania Railroad, for what he calls an impact tool. It is an ingeniously contrived hand tool operated by a "motive fluid," which is likely compressed air, and is adapted to use as a caulking or chipping tool.

Although our supply of mechanical and engineering books was burned, we are still in the business of selling them. Send for our "Book of Books" and see what we can do.

Plain Talks to the Boys.

BY C. B. CONGER

So you want to know what a fireman should learn before he is promoted to engineer?

Well, that question will take a pretty long answer, for everybody has a different idea of this matter. Some will say that if you have fired three years for a good man who shows you all the points about an engine you will know enough when you get promoted. That view leaves out the question of learning how to handle a heavy train in the most successful way, but probably it is understood you will learn that from observation of how it is done by the various engineers you may be with.

Others say that you cannot learn everything necessary by experience, as in all your experience as a fireman you may never see anything get disabled on your engine. So that unless someone tells you how it should be done you will not know just what to do in case of a breakdown. Both of these views are right as far as they go, but they do not go far enough into the subject. But that does not answer your question as to what you should understand and practice as a fireman while firing, and what knowledge of the engineer's duties is necessary before promotion.

We won't say anything about having good judgment and an even temper, for if you are not already built that way it cannot be learned from someone else telling about it. Sad experience tells about this in a convincing way. You should be a fair penman and have a good knowledge of arithmetic, for railroading has considerable mathematics in it. Everything has to be explained on paper; if you are not handy with a pen you may come out second best when you are called on to "please explain."

In the first place you should know all about the fireman's duties around the engine house, as well as out on the road, and how to fire the different classes of engines in use on your road to get the best results. If there is any class of engine that does not steam as freely as the others, it is a good plan before you are promoted to ask to make a few trips on them in charge of the scoop, so that if you get one to run you will be on to their curves and be able to handle your train satisfactorily. "That would look as though you were going to be the fireman instead of engineer after promotion," did you say? Maybe it does look so to you to-day, but you will find out when you get promoted you are liable to get one of the poorest engines to work with; they do not pick out the best for the beginners, as they ought to so as to have a fair show. And you won't get an old experienced fireman with you; more likely you will have a new man like yourself. Now, as the engineer is held responsible, he will have to see that the fireman does the work right. That is where it comes handy to know how yourself. You will have to tell him how from time to time on the trip, as you will not have time to handle the scoop and show him how. Can you show anyone else how to fire properly unless you know enough about it to be able to explain it?

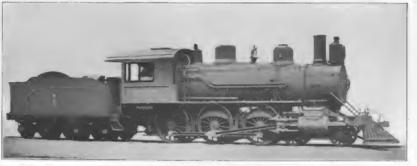
As you will likely be examined on the train rules, telegraph orders and time card, of course—"You have passed examination on all that," you say? Have you also passed the air brake examination? No? Well, of course, you will need to get ready for that, but that is a comparatively easy part of the whole business, so we will pass that now and take it up later; for the present talk about what you can learn while you are firing freight.

You should learn the shutting-off places of each engineer you fire for, so that you will not be caught with the door open and a heavy green fire when he closes the throttle. That is the fireman's view of it, but when you are promoted you will want to shut-off where the train will run in at the proper speed, so as not to lose any time and still make a good easy stop. Of course, it goes without saying so here, that different trains will have different speeds, more or less brake power, be very heavy or light, and the condition of the rail is constantly varying, so that you as engineer will be called upon to use some judgment as to the proper place to shut off.

If the road is up hill and down, with sags in the line at one place and hogbacks at another, you will have to learn where to ease off on the throttle and where to work steam hard to keep the train stretched out and not break it in two. This point will bother you if you are a passenger fireman only, but it comes easy for a freight fireman to learn this early; probably having to look back for the markers and watching on his side of the curve for break-in-twos impresses it on his mind.

When following another train it is a good plan to learn how far off a caboose is. When the faint red spot you see ahead of you begins to separate into the two or more red lights, which are on its rear end, then you will know when to begin to stop. In the daytime you can judge very closely where it is by the land marks near it, but in the night on straight track you have no doubt seen an engineer get ready to stop three miles from a caboose, while another one will make his full speed up close and then stop just far enough back to be safe, as easily as if it was daytime. It pays to learn how he does this.

In the matter of coal and water, get in the habit of estimating closely just how much coal there is in the tender at various points along the road, and how much is used with a full train making the card time from one point to another. Figure on how many miles per ton your engine



Descriptive diagram on page 17.

ROGERS TEN-WHEELER FOR ILLINOIS CENTRAL RAILROAD

will make over the whole division, and how many miles over the hard parts, say for twenty miles, and then on an easy part of the road on same division. Then you can tell within a part of a ton, or a bushel, whether there is enough on the tender to take your train in or out. This information is important, for a stop for coal may knock you out of several meeting points and make a difference of hours in arrival at terminal.

"It don't pay to shovel off the hind end," you say? Well, that is so sometimes and not so at others. It depends on a good many conditions. If you do not believe in shoveling coal off the hind end of the tender when you are firing, practice as an engineer what you preach as a fireman; maybe this advice may change your decision now.

As to the estimate of the amount of water used, does it make you tired to stop at every water plug on the division and find over a half of a tender of water each time with one engineer, while with another man you only stop at every other one and never get short of water? Of course it does, and when you dig down for the reason—it will be close to the surface—you will find that the man who has to stop at every water plug does not know anything about how much water it takes to run from one plug to the next, and how much there is left; or else he is wasteful of water in handling his engine.

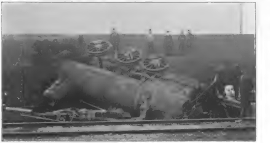
See that your tank is full when leaving the terminal, and the cover on the water hole; when you next take water measure and see how much there is gone till you are able to estimate it accurately. Do this at all succeeding stops for water. Then you will soon know how many inches of water it has taken to bring the train so many miles, and this practice will train you so that as an engineer you will know whether it is practicable to go by a water plug to the next one. For instance if you have used eighteen inches of water in pulling your train twenty miles up grade, you are safe at one inch a mile for the next stretch to a water plug.

After you once learn as a fireman these methods of closely figuring on how far the supply of coal and water which you have on hand will take your train, the engineer will show his confidence in your judgment in this matter, which will give you a chance to test it every trip.

All these things should be learned early in your education as a fireman, say, before the second year; if no attention has been paid to them get a hustle on yourself at once. Do not make the common mistake of trying to learn the engineer's part of railroading first; learn how to be a skillful and reliable fireman first, last and all the time.

As to breakdowns and other disabilities of a locomotive; when one breaks down get around and see how she is blocked up or disconnected. An object lesson of this kind is worth a whole page of what can be written about it.

If your engineer takes an interest in you, he will explain how and why such work should be done; if he does not, there must be some good reason for it. Be good natured in your search for information and success will come.



EXPLOSION OF A FRENCH LOCOMOTIVE.

You should learn how to locate, as far as possible, the trouble in a disabled engine before any part of her is taken down; if the disabled part is in sight, this will not take long. More than half the mistakes made in getting ready to move your train again are made in locating the disability. When once it is located, go to work the shortest way to get ready to move your train, and have it done securely, so you will not have to stop again. You should know whether it is better to send for help at once or try and get in without assistance; delays are expensive.

As to learning how to handle breakdowns from an instruction book, while some of the directions given will not fit your case exactly, yet they will set you to thinking when you study over the book. By all means post yourself up on how other men look at these matters; you may read of more than one way to block up or get in a disabled engine. Come around later after you have studied what books you can get hold of, and we will talk of this matter. There is a prejudice against learning railroading out of a book; never mind that; go ahead and learn wherever you can; that is what you subscribed for LOCOMOTIVE ENGINEERING for. The trouble has been that a man without experience who learned anything out of a book thought he knew it a little better than the man who had learned it by experience; that of course made the practical man jealous at once. Learn all you can out of books to help out what you learn by experience; life is too short nowadays to learn it all by one of these methods only.

You should know how to handle the various makes of injectors in use on your road and where to look for the trouble in case one of them won't work out on the line. Some of them get out of order in one part, others in another; when your water is getting low in the boiler quick work at a balky injector is required.

Go into the back shop and have a talk with the man who cleans and repairs them. He can tell you where the troubles are apt to be located; you can then study out how to remedy them. The sight-feed lubricator is so generally used on locomotives that very few firemen get old enough for promotion without knowing how to care for and operate them.

When you go to running, it is likely you have learned all about where the grades begin and end, so as to know where to take a run for a hill or where you can pull a train over.

"You would like to hear some more about firing coal, so you can show a new man how," would you? Well, now, that is a good sign that this talk has set you a-thinking. There is not time enough for that to-day; but the next time we meet, that will be the subject for discussion.

Mechanical stokers have been used very successfully for years for the firing of stationary boilers, but attempts to apply them to marine or locomotive boilers have been failures. A New York concern has, however, undertaken to apply a mechanical stoking plant to a large vessel trading on the Lakes and to guarantee its success. There are three stokers, guaranteed to burn 1,650 pounds of coal per hour and 2,100 pounds under forced conditions. The guarantee stipulates that the stack shall be perfectly smokeless, the only smoke possible being when the fires are being cleaned or when new fires are being started, or when the fires are being unduly forced.

Don't be discouraged or provoked if your book orders are not filled as promptly as formerly, for we had absolutely nothing left in stock, and it takes time to get them together again. If we can't supply the books, your money will be returned—but give us a little time.

A Pair of Recent Brooks Locomotives.

We show on this page illustrations of two locomotives recently turned out of the Brooks Locomotive Works, that possess features that make an interesting comparison. Both are for heavy freight service; one for a far Western road, the other for a road in Western New York and Pennsylvania. The consolidation locomotive is for the Oregon Railway & Navigation Company; the twelve-wheeler for the Buffalo, Rochester & Pittsburgh. Both are single-expansion engines, and both are intended for pulling very heavy trains over steep grades.

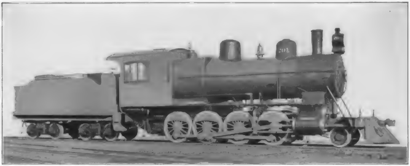
engine 33,490 pounds tractive power. At that rate the coefficient of adhesion is 4.

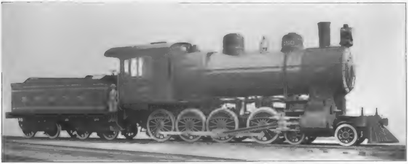
The twelve-wheel engine has cylinders 20 x 26 inches; driving wheels 55 inches diameter; a boiler providing 2,298 square feet of heating surface, and 32.4 square feet of grate area. The weight of this engine is 156,000 pounds, of which 126,000 pounds rest on the drivers. In this case the tractive power is 29,672 pounds and the coefficient of adhesion 4.2.

Fuller particulars of the dimensions of the engines will be found on the outline diagrams.

with the assistance of Ross Winans. Davis sent to his shop in York for his "drawings," but they were not on paper—more substantial than that, they were on wood. He had used shingles, scraps of board or any old thing he could find. With the aid of these the "York" was remodeled, and served as a standard for others, for a short time.

Baldwin Locomotive Works have favored us with No. 8 of their "Record of Recent Construction," which forms a very interesting series for those interested in modern locomotive building. It includes gages from 23½ inches to 5 feet and several distinct types of locomotive. The engines go to the various parts of the world.





A GOOD TEAM.

The consolidation engine weighs 154,000 pounds, of which 136,000 pounds are on the drivers. The cylinders are 19 x 30 inches; the driving wheels 55 inches diameter, and the boiler has a total heating surface of 2,162 square feet, and the grate area is 32.4 square feet. The working boiler pressure is 200 pounds per square inch. Under the Railway Master Mechanics' rule of 85 per cent. boiler pressure as the mean effective cylinder pressure at low speeds, this would give the

Locomotive Drawings in 1831.

The complete drawings of locomotives and other machinery that we see to-day, and which are necessary in modern locomotive building, are in marked contrast with some of the methods in vogue in the earlier days.

In 1831, after Phineas Davis, the watchmaker, of York, Pa., had earned the $4,000 prize offered by the Baltimore & Ohio for the best locomotive (the "York"), he went to work to improve it,

A man named Tomlinson has been convicted in an English court for having made three attempts to wreck passenger trains. He was sentenced to penal servitude for life, a hard punishment that was richly deserved.

How to Set Valves.

BY IRA A. MOORE.

The present practice in most railroad repair shops of having special men for doing the different parts of the work does not give the apprentice a very good opportunity to take part in all the work, and the man who does the valve setting is apt to be thought of by the boys as knowing something that few can learn, and some men who do the work seem to try to make the operations of valve setting appear as difficult and mysterious as possible. That there is nothing so very perplexing connected with this part of the work we will endeavor to show in what follows.

Suppose we are working on an engine that has an indirect link valve gear. The outside lap of valves is ¾ inch and they are line and line inside. Since the work is to be done with the steam chest covers screwed down, we must have some way to know the position of the valve on the seat without seeing it. For this purpose we will use a tram like that shown in Fig. 20, and the points *a* and *b* on valve stem, and point *c* on steam chest stuffing box, all shown in Fig. 21.

Point *c* may be in any convenient place, but it is generally a little to the outside of the top of stuffing box. We will now find the points *a* and *b*, which must be

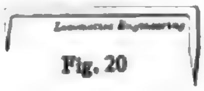


Fig. 20

done before the chest covers are put on. Slide the valve ahead until it is just beginning to uncover the back steam port. A piece of tin is usually slipped between valve edge and port edge to prove that the port is beginning to be uncovered. Then place the short point of the tram in the point *c*, Fig. 21, and with the long point scribe an arc across the top of valve stem. Draw a line on top of and parallel with the stem, then the point of intersection of the line and arc will be the point *a*, which should be marked with a small center punch mark. Now slide the valve back until the front port is just beginning to open, then proceed to get point *b* as *a* was found. The distance between *a* and *b* is equal to twice the lap of the valve. Before getting these points the valve stem gland should be in place, also the valve rod connected up, thus keeping the valve stem the same hight, since any variation in the hight of stem will cause the tram to extend a greater or less distance back of *c*. Hence the necessity for keeping the stem the same hight as when it was marked. Theoretically, when the valve is on the center of the seat, the upper rocker arm should be at right angles to the seat, and the length of the valve rod should be such as will bring these conditions about. Otherwise the valve will not travel the same distance each way from the center of seat. Practically, the rod can be ½ inch either way from this length without having any injurious effect on the valve's travel. But it is well to know how to find the proper length of the valve rod. On the end of the rocker shaft scribe a circle, whose center is the center of shaft and whose diameter is the same as that of the hole for the pin in the top of arm, Fig. 22. Put the valve on the center of the seat, which position will be indicated by the tram reaching from *c* to a point *d*, midway between *a* and *b*, Fig. 21. Also put a line with a weight on each end of it over the valve-stem pin, as shown in the Fig., then lengthen or shorten the rod until the lines touch the circumference of the circle on end of shaft.

Before commencing to get the dead centers it is well to know that the driving wedges are properly adjusted. Also see that the eccentric rods are connected in the right way, that is, the forward motion rod to the top of link and backward motion to the bottom. Remember that with an indirect link motion, such as we are dealing with, the eccentric that is controlling the valve always follows the crank pin, or when the pin is on the forward center the forward motion eccentric will be almost above the axle, and the other almost below, and both will be advanced or turned toward the pin enough to overcome the lead and lap of the valve. We will not expect to get the eccentrics in exactly the right place at the start, but will set them as near as possible without doing any measuring, or, in other words, we will at first guess at their position.

Now proceed in the following manner to find the exact dead centers and length of eccentric rods. It is important that the dead centers be accurately located. While the crosshead moves very little when the pin is near the center, yet the valve is at about half travel. Hence it is moving at nearly its greatest velocity, and a slight error in finding the dead centers will seriously affect the accuracy of the work.

It makes no difference which center is found first, but for convenience we will get the front one on the right hand side. Suppose the pin to be above the center. Make a center punch mark at any convenient place on the wheel cover, say at *e*, Fig. 21. Then turn the wheels ahead until the cross-head is about ¼ inch from the end of its travel. With one point of a tram, similar to Fig. 23 (which is made of ½-inch steel and is about 12 inches long), in the point *e*, scribe the arc *f* on edge of tire, and before moving the wheels, with the same tram, and with point *j* on front guide block as a center, scribe the arc *k* on cross-head. Now turn the wheels ahead past the center far enough to bring the arc *k* slightly back of the tram point. When the other end of tram is in the center punch mark *j*, turn the wheels slowly backward until the arc *k* has the same position that it had when it was made, which position can be found by holding one point of the tram in *j* and stopping the wheels when the other point reaches the arc.

Now scribe the arc *g* on the tire, using *e* as a center. With dividers bisect the distance between *g* and *f* and get the point *h*. Perhaps it will be well to explain why when the wheels were turned until the pin passed the center they were turned enough to carry the cross-head farther back than when the arc *k* was down. At that time the pin was pushing the cross-head forward, and consequently the lost motion

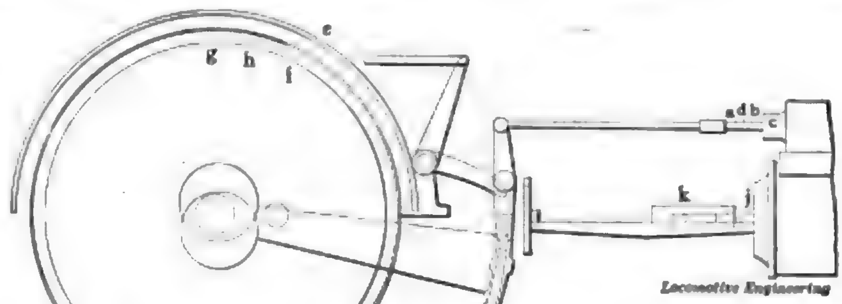


Fig. 21

between the pins and brasses was taken up in that direction. If we had stopped the motion when the pin had passed the center and the cross-head was traveling back, the lost motion would have been taken up in the opposite direction. Hence the arc *g* and also the point *h* would have been slightly away from the proper place. But when the cross-head was pulled back past the right place then the direction of the motion changed to bring it ahead again, the strain on the rod was the same as when the arc *f* was drawn.

We have found the point *h* and the pin is now a short distance below the center. Throw the reverse lever back as far as it will go, then turn the wheels backward until the tram will reach from *e* to *h*, then the pin is exactly on the dead center. With the short point of the valve stem tram, Fig. 20, at *c* scribe an arc *m*, Fig. 24, on the valve stem from the top to the outside.

The reason this arc is drawn from the top to outside of stem is because the backward motion eccentric is moving the valve, and this eccentric is on the outside, or nearest the driving box. In this way

it is easy to remember which marks were made for the backward and which for the forward motion.

After scribing the arc *m*, and before moving the wheels, make a mark across the outside edge of the outer guides opposite the end of cross-head. This mark indicates the end of the stroke, and we will have occasion to use it later. Turn the wheels back enough so that when they are turned ahead again all the lost motion in eccentric straps and other connections will be taken up in that direction, then put the reverse lever in full forward motion and turn the wheels ahead to the center. Now with the valve stem tram scribe an arc on valve stem from the top to inside of stem shown at *p*, Fig. 24. We now know the position of the valve on the seat for both forward and backward motion when the pin is on the front center on right side. Get the other dead centers and positions of valve in the manner described.

We will now proceed to adjust the eccentric rods to the right length. Fig. 24 is a top view of the right valve stem after it has been marked as described above. The arcs *o* and *p* were made with the lever in the forward motion, and *m* and *n* with the lever in backward motion.

When the tram, Fig. 20, reaches from *c* to *a* or *b*, Fig. 24, the valve is at the point of cut-off, and since the valve is to travel the same distance each way from these points, we can measure from *a* and *b* to the arcs to determine how much and whether to lengthen or shorten the eccentric rods.

First the forward motion: Suppose the distance (measured on a line through *a* and *b*) from *b* to the arc *p* to be ⅛ inch, and from *a* to the arc *o* to be ⅜ inch, thus indicating that the valve is traveling farther ahead than back of the center of the seat, also that the forward motion eccentric rod is too short. Since the arc *p* is back of *b*, and *o* is back of *a*, the amount to lengthen the rod is equal to half the sum of the distances *o a* and *b p*, or

$$\frac{\frac{1}{8} + \frac{3}{8}}{2} \ \tfrac{1}{4} \text{ inch,}$$

provided the upper and lower rocker arms are the same length. If, as is often the case, the lower arm is the shorter, the length of the rod will not have to be changed quite as much as is indicated by the mark on valve stem. But we will suppose the arms to be of equal length, therefore will lengthen the rod under consideration ¼ inch. The distance from *a* to *o*, before changing the length of the rod, was ⅜ inch. The change will shorten this distance ¼ inch and bring *o* ⅛ inch back of *a*; *p* will also be ¼ inch farther ahead, which will put it ⅛ inch ahead of *b*, or the same distance that *o* is back of *a*, thus "squaring" that side of the engine in forward motion.

The manner of finding the amount to change the length of the backward motion eccentric rod is not quite the same, because one of the arcs is already back of and the other in front of the points *a* and *b*. The distance between *a* and *n* is 5-16 inch, and between *b* and *m* 3-16 inch, which shows that the backward motion rod is too short, and it must be lengthened half the difference between the distances *a n* and *b m*, or

$$\frac{\frac{5}{16} - \frac{3}{16}}{2} = \frac{1}{16} \text{ inch.}$$

This will bring *n* 1-16 inch nearer to *a*, making the distance between *a* and *n* ¼ inch; and *m* will be 1-16 farther from *b*, making their distance apart ¼ inch, which will square the valve for backward motion. Now adjust the rods to length on the other side of engine in the same way.

Perhaps the following rule for determining the amount to change the length of eccentric rods will be beneficial to some:

When the arcs on valve stem are both back, or both ahead of the points of cut-off, the length of the rod should be changed an amount equal to half the sum of the distances between the points and arcs, or where one arc is back and the other ahead of the point of cut-off, the length of the rod should be changed an amount equal to the difference of the distances between the arcs and points.

engine is running; hence the eccentric should be turned backward enough to take off all the lead, then turn it slowly ahead until the valve stem tram will reach from *c* to *v*, Fig. 24. Fasten the eccentric in that position. Turn the wheels ahead about 6 inches; put the reverse lever in full back gear, then turn the wheels back to the center and proceed to set the backward motion eccentric.

After getting the backward motion rod the right length, we found that the valve had ⅛-inch lead, which must be reduced to 1-16 inch, which can be done in the same way that the forward motion was adjusted.

The forward motion eccentric is set first because it is easier to get it than the other one; then if the backward motion eccentric has to be changed enough to affect the lead in forward motion, the forward motion eccentric can easily be reset, and it will be necessary to move it so little that the backward motion will not be affected enough to require any further attention.

Now throw the lever ahead again and turn the wheels ahead to the front center on the other side; then in the manner de-

Fig. 22

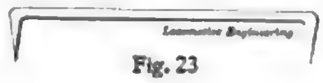


Fig. 23

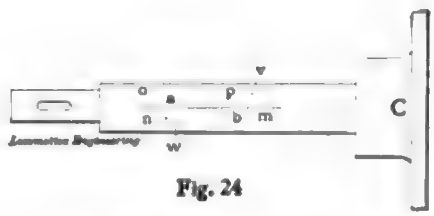


Fig. 24

It is desired to give the valves 1-16 inch lead in both forward and backward motion in full gear, and before setting the eccentrics it is necessary to have some marks on the valve stem to guide us. To get these points, set a pair of dividers to the distance between the points *a* and *b*, Fig. 24, plus the lead, or in this case 1½ inches plus 1-16 inch equals 1 9-16 inches. Then with one point of dividers in *a* scribe an arc *v* across the top of valve stem in front of *b*, then with *b* as a center scribe the arc *w* back of *a*.

We will set the forward motion eccentric first. Put the reverse lever in full forward motion, then turn the wheels ahead until the center is reached. Suppose it to be the front center.

When getting the length of eccentric rods we found that with the engine and lever in this position the valve lacked ⅛ inch of closing the port; or, in other words, the valve had ⅛-inch lead. Hence it must be reduced to 1-16 inch.

This could be done by turning the forward motion eccentric backward, but that would take up the lost motion in the opposite direction from what it is when the

scribed, set the eccentrics on that side. The engine is now square and has the right amount of lead all round; but notwithstanding this the valves may not—in fact, very seldom do—cut off the steam the same distance from the beginning of the stroke at each end of the cylinder, and one cylinder may be getting more steam than the other.

The cut-off may be equalized for each end of the cylinder by changing the position of the saddle stud; but with case-hardened links and the saddle bolted rigidly to the link, this is not always practical, and some other means must be employed to adjust the cut-off.

A very common way is to equalize the forward motion by changing the length of the backward motion eccentric rods, which will affect the equality of the lead as well as the cut-off in back gear.

Another method employed to a considerable extent is to give up equality of lead in both forward and backward motion for equality of cut-off. But before we can use either plan, the points of cut-off must be found; so we will proceed to find these points.

Suppose the engine to be on the front center on right side. Turn the wheels backward until the crosshead has traveled, say, 6 inches from the beginning of the stroke; then stop the motion and with the short point of the valve stem tram in *c*, Fig. 21, move the reverse lever back of the center until the valve closes the port, or until the tram will reach from *c* to *b*. Put the lever one notch farther back, then turn the wheels backward until the tram shows that the point of cut-off is reached. Now measure the distance from the beginning of the stroke to the front end of the crosshead. Suppose it is found to be 7½ inches; mark this down with chalk on the front end of the outside guide. The outside guide is used for the backward motion because the backward motion eccentric is on the outside. Turn the wheels farther back until the steam is cut off on left-side back end of cylinder.

We will assume that the cut-off takes place at 8¾ inches. Turn the wheels back again until the right pin passes the center and the steam is cut off, say, at 8 inches. Turning the wheels still more back until the left pin passes the front center and reaches the point of cut-off, will give the cut-off for the four strokes. Here the cut-off takes place at 9 inches.

According to the above, the cut-off for the right cylinder takes place at 7½ inches of the backward, and 8 inches of the forward stroke. Left cylinder backward stroke, 9 inches; forward stroke, 8¾ inches. To equalize the cut-off on left side will shorten the backward motion eccentric rod, and how much to shorten it can be found thus:

As stated above, the cut-off for the forward stroke occurs at 8¾ inches, and for the backward stroke at 9 inches. The average is

$$\frac{8\frac{3}{4} + 9}{2} = 8\tfrac{7}{8} \text{ inches.}$$

We left the wheels with the left crosshead at the point of cut-off, or 9 inches back of the end of the stroke, and it is desired to have the cut-off take place at 8⅞ inches. Hence, turn the wheels enough to bring the crosshead 8⅞ inches back of beginning of stroke, and enough more to take up the lost motion, then turn them back until the crosshead is at the place where the cut-off is to occur. With the valve stem tram make a mark on top of the valve stem; in this case it will be slightly ahead of *b*, Fig. 21. The distance between this mark and *b* shows how much too far back the valve is traveling; hence the eccentric rod will have to be shortened enough to throw the valve that much ahead. The other side of engine can be treated in the same way, which will make the cut-off on left side at 8⅞ inches, right side at 7¾ inches—considerable difference in the two sides, but this will be remedied later on.

Commencing with the backward stroke on right side, we will now get the cut-off for the forward motion. Turn the wheels ahead until the pin passes the forward center and draws the crosshead back, say, 6½ inches. Move the lever slowly ahead until the valve closes the port, as indicated by the valve stem tram, then put the lever in the first notch ahead of that position and leave it there until the cut-off has been found for the four strokes. Now turn the wheels ahead until the point of cut-off is reached. We will suppose it to be 8 inches back of beginning of the stroke. Mark this down on front end of right inside guide, then turn the wheels ahead and get the cut-off for front end of left cylinder, which is at 7 inches. Again turning the wheels ahead find the back end of right side to be 8¾ inches, and the back end of left side to take place at 8 inches.

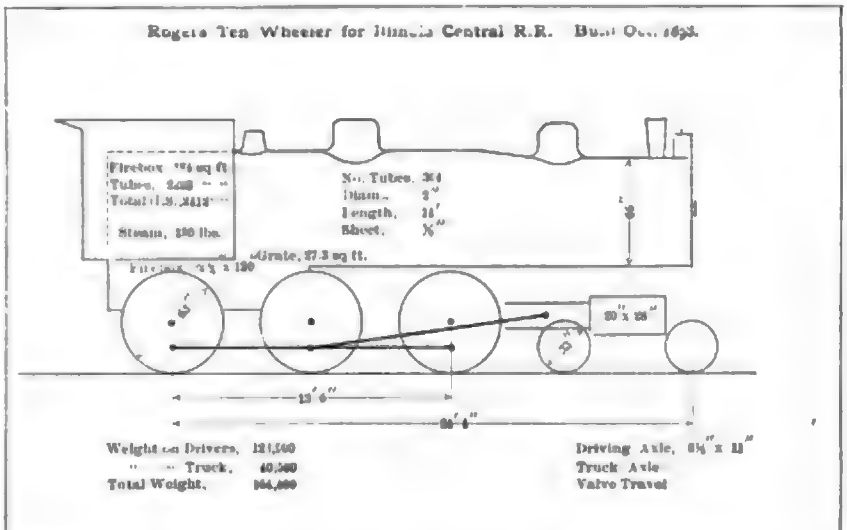
We will equalize the cut-off on left side first. Cut-off for forward stroke is 8 inches, and for backward stroke 7 inches, making an average of 7½ inches, and indicating that, in order to equalize the cut-off, the eccentric rod must be lengthened. Turn the wheels back until the crosshead is enough less than 7½ inches from beginning of stroke to overcome all lost motion, then turn them ahead enough to bring the crosshead the 7½ inches from beginning of stroke.

With the valve stem tram make a mark on top of valve stem. The eccentric rod must be lengthened enough to draw the valve back a distance equal to the distance between the mark just made on valve stem and the point *a*, Fig. 21.

Adjusting the right side in the same way will give an 8⅛-inch cut-off on the right side, and the left side cuts off at 7½ inches. Notice that in back gear the cut-off is latest on left side and in forward gear earliest on that side.

This inequality can be overcome by lengthening the link hanger on left side, or shortening the hanger on right side. We will lengthen the hanger on short side, but before doing so the amount to lengthen it must be found. To do this, put the reverse lever in the same notch of quadrant that it was in when the cut-off in forward gear was found, and measure the distance from any stationary point directly above or below the upper link hanger pin on left side to the center of that pin. Now turn the wheels ahead until the left crosshead is as far from the beginning of the stroke as the right one is when the steam is cut off, or in this case 8⅛ inches. This is where it is desired to have the cut-off take place on the left side.

Move the reverse lever ahead three or four notches, then move it slowly back until the steam is cut off as indicated by the valve stem tram. Again measure the distance from the same stationary point to the center of upper hanger pin. The difference in the distances between the point and center of pin is the amount the hanger must be lengthened to equalize the cut-off on the two sides; or raising the tumbling shaft box slightly more than this on the right side would have the same effect as shortening the hanger on that side.



Engine Diagram. *Locomotive Engineering*

Let us see what effect this change will have on the back gear. The cut-off in that gear took place at 8⅞ inches on left side, right side at 7¾ inches. The nearer the link block to center of link the shorter the cut-off. The change we have made in the hanger will throw the block farther below the center of link in forward gear; hence will delay the cut-off. In back gear, lengthening the hanger as has been done will throw the block nearer the center of link, and will accelerate the cut-off, which is the effect wished for to make the two sides cut off nearer equal in back gear. The amount the hanger has been lengthened may not exactly equalize the cut-off in back gear, but it will be near enough, since the engine does very little work in back gear. In order to allow about the same volume of steam to be admitted to each end of the cylinder, the cut-off should take place ⅛ or ⅜ inch later in the back than in the front end. This is owing to a part of the space between

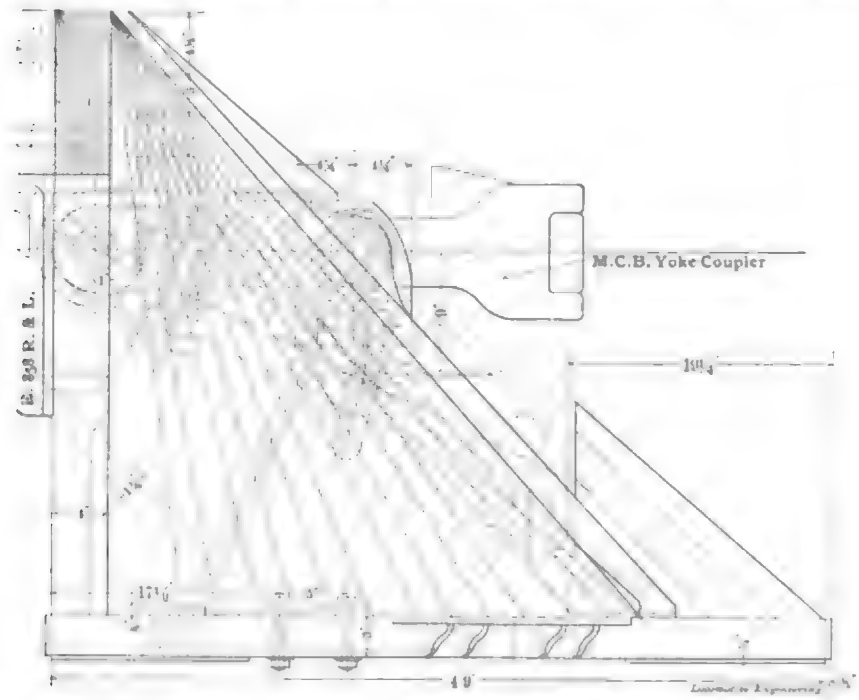
piston and cylinder head being occupied by that part of the piston rod within the cylinder. In the foregoing the equality of lead has been destroyed in both gears for the benefit of the cut-off. Had it been desired to preserve the equality of lead in forward gear, it would not have been necessary to find the points of cut-off in back gear, and the cut-off for each end of the cylinders would have been adjusted by altering the length of the backward motion eccentric rods.

The adjustment for each side of engine would have been made as has been described.

Cleaning Boilers Without Washing Out.

That idea of keeping a boiler clean by not washing it out, as advocated and followed out by Superintendent of Motive Power Mackenzie, of the N. Y., C. & St. L., has the merit of novelty at least, besides preventing the leakage of flues and fireboxes. The whole system hinges on the arrangement of blow-off cocks and how they are handled, and comprises a blow-off cock at each of the four sides of the firebox and up out of the mud, the cocks having communication with perforated pipes which extend down the water leg to within an inch of the mud ring. Engineers are prohibited from using the blow-off cocks on the road unless in case of absolute necessity, the idea being that by blowing at the proper time an engine may be run almost an infinite time without washing out.

It is believed by Mr. Mackenzie that his experiments are destined to entirely change wash-out practice in bad-water territory. There is no more prolific cause of firebox leakage than blowing out a hot engine, and on roads where the water is so bad in some districts that an engine has to be washed out each round trip, and sometimes at each terminal, any scheme that gives promise of relief will be welcome, not only to the motive-power department for the saving in reduced cost of maintenance, but to the train dispatcher that is waiting for the engine to be cooled down and washed out.



Drop Pilot Coupling.

The drop pilot coupling hereby shown requires no description. It is the invention of Mr. C. F. Thomas, master mechanic of the Southern Railroad, and has been applied to a number of locomotives on that road. The mechanism for holding the bar in working position is strong and simple, the two leading requisites of such an apparatus.

Outside Versus Inside Cranks.

The inside connected engine is, to all intents and purposes, a curiosity to people in this country to-day, but there are those yet living who beheld the present outside connected machine with just about the same feeling of amazement as would those of this generation view the type now obsolete. The process of evolution is at work abroad, and it will probably be but a few years when the inside crank will entirely disappear from the haunts of man. Stephenson's "Rocket" was an outside crank engine, but what the influences were at work to turn the tide of design the other way, locomotive history does not say. It is a matter of record, though, that the inside connected engine was, and is, the popular form of construction in England and on many continental roads to-day, notwithstanding the fact that it is slowly but simply obeying the law of evolution to ultimately disappear and be replaced by a radically different type of machine. This work has only begun, but the signs of change are plain to be seen.

Smoke Prevention.

A lively interest is being taken in all aspects of smokeless firing, owing to the late agitation of the subject; an interest, it is fair to believe, that is sure to be productive of more lasting good than any that has heretofore been awakened only to languish and die for want of encouragement. There are a great many different schemes afoot, all looking to the common end of smoke-prevention, and all depending more or less on the manner of firing to get results. On the Cincinnati Southern, Superintendent of Motive Power McCuen has been quietly pursuing the subject on lines that combine a hollow, brick arch and a carefully calculated area of air opening above the grate in connection with deflectors to put the air in the proper place. The fire door is always on latch, a practice largely followed on other roads; but whatever the cause, the engines do not throw smoke or cinders with bituminous coal for fuel.

The Storm in New England.

The heavy storm in New England is held responsible for many curious as well as disastrous results. One of the former is the freaks played with the tracks of the Plymouth division of the New York, New Haven & Hartford Railroad.

If the illustration in one of the dailies is to be believed, the wind and waves forced the track from its road-bed along the shore, back into a huge semi-circle evidently of several hundred feet radius. Piles of ties are said to have been moved bodily without being disarranged, but that is rather a hard yarn to swallow. At any rate it was a bad storm for all kinds of transportation.

Ball Bearings in the Tool Room.

The tool rack in the tool room of a large shop is one of the most used of all the equipment in it, and whether it is stationary or one of revolving variety usually depends on the number of tools passed out; but sometimes the enterprise of the genius behind the gate is a factor in the problem, and in such a case the rack is a revolver. The convenience of this rack is best understood by the man that uses it, and it is only natural that he should like to have it work as easily as possible, for the reason that the less exertion laid out in one direction leaves a margin to draw on in another.

One of the best arrangements of the kind yet gotten up is that in the Brainerd shops of the Northern Pacific. This rack comprises a series of octagonal shaped tables, one above the other, but each revolving separately on its system of ball bearings. There are twenty 1-inch balls under each rack, which is slanting to a pitch of about 30 degrees. The slightest touch is sufficient to move any of them. For its purpose it is not easy to conjure up anything that will save more time or steps.

Practical Letters from Practical Men.

All letters in this Department must have name of author attached.

Exhaust When Engine Is Drifting.

Editors:

I have observed in all locomotives I run equipped with the American balance valves, that when engine is drifting down hill, with steam shut off, a very distinct exhaust is heard at each end of stroke, like engine working with light throttle. This can be heard very plainly by standing on top of boiler near stack; also in drifting 40 or 50 miles an hour it can be detected in firebox by the roaring sound and the fanning of the fire.

I have never discovered these conditions on engines equipped with the Richardson balance or the unbalanced valves. I am unable to solve this action, and have asked a great many, and have so far received no satisfactory answer. Can any of the readers of LOCOMOTIVE ENGINEERING give an explanation?

I. F. WALLACE,
C., St. P., M. & O. Ry.

Altoona, Wis.

[We refer this question to our readers and trust that some of them will send us an explanation.—ED.]

Roller Center Bearings for Cars.

Editors:

Referring to an article on page 570 of December number of your paper, on a lubricating center plate: The article closes by saying that the next thing in order will be a ball-bearing center plate. I wish to say that the ball-bearing center plate has already arrived, and is now being used on the Seaboard Air Line, a sketch of which I herein enclose to you.

No explanatory remarks are necessary to call your attention to the present bearing now in use between car-body bolster and truck bolster. You understand thoroughly the strain brought to bear on wheel flanges when a car heavily loaded comes from a tangent onto a curve, and we also know that with the old style flat center bearings a truck does not right itself with the track, coming from a curve onto a straight track, but causes flange friction incessantly. We also know that three-fifths of all wheels removed from under our cars is on account of sharp flanges. If we ask our chief engineer what is the life of rails on sharp curves, he will say from two to three years, and he will also tell us that the life of the same rails on straight track is from ten to fifteen years; and again, the coal pile on the locomotive suffers greatly on account of flange friction at rail.

In Fig. 1 you will see the relative position of top and bottom center plates, with their bearing on the ball, or rollers, between them; these balls are placed in scoop-shaped bearings, marked 9 in Fig 2. In rounding a curve, the balls roll up an incline or to the shallow part of the scoop, raising the car to a certain extent from off the side bearings, and when straight track is again reached, from the weight of the car on top and by force of gravity the balls will find the lowest spot in bearing 9, and straighten truck on track. Either one or more rows of balls can be used, or conical-shape rollers if desired. You will notice in Fig. 2 the boss No. 5, and in Fig. 3, cavity No. 6, that the male and female features are still

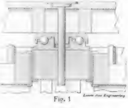


Fig. 1

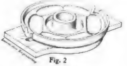


Fig. 2

Fig. 3

ROLLER CENTER BEARINGS.

retained. This of course prevents the car from being knocked off the center or balls dislocated. The flange or collar, as shown in Figs. 1 and 2, marked 10, is simply a guard or shield to prevent sand or grit from getting into bearing. This feature, however, is optional, whether used or not. You will notice there is absolutely no lateral or transverse motion to this bearing. It will appear to you that the balls will either flatten or crush when supporting their heavy load; but I will say that I have tested these rolls in our hydraulic press and they stand 40 tons pressure each, before cracking. You will see, therefore, that the factor of safety is sufficient. The balls were of common cast iron. I would recommend, however, that the balls be made of cast iron chilled. I have been running this center plate for some time, and find no perceptible wear on the balls. You will notice in Fig. 1 the amount of bearing on each ball. The shape of the scoop in top and bottom plate is made for this neat fit on the ball. The center plate can of course be made in accordance with design to fit any style bolster, and should be made either of malleable iron or cast steel.

There is no liability of the balls being displaced by bumping or rough handling of cars, as you will see in Fig. 2 a rib divides each cavity, and it would be necessary to raise the car 1½ inches to get the balls out, as they are 2¼ inches in diameter. The clearance between the top and bottom bearing is ½ inch.

C. B. ROYAL,
Master Mechanic.

Portsmouth, Va.

Railroading in Africa.

PART I.

Editors:

Perhaps some of the many readers of LOCOMOTIVE ENGINEERING would like to hear a word about the Beira Railway. In July, 1896, I commenced work for the Beira Railway Company, and remained in service about six months; then went on a hunting expedition, and remained in that country until April of this year.

The headquarters of the Beira Railway at present are at Beira, a seaport town on the Indian Ocean, at the mouth of the Pungwe and Busi Rivers, in Portugese East Africa.

The road last April had reached Umtali, a distance of about 235 miles from Beira.

I nearly lost my life twice with fever, having had an attack of black-water fever the last time. That is undoubtedly an interesting country, though deadly, and I desire to see it before I return to the States. I am the only American I know of on the hunting field on the East Coast, and have met only one American on a hunting trip; that was Mr. Humbert, of New York. I would like to take out a hunting party of New Yorkers next season. I could show them grander sport than an American Indian ever dreamed of.

In July, 1896, the two terminal points were Fontesvilla and Chimoio, a distance of 118 miles, one division. We used to run from Fontesvilla to Eighty Miles; camp all night; next day to Chimoio, and return to Eighty Miles, and third day re-

turn to Fontesvilla. Trains used to be run in sections, both ways, from one to four, and sometimes five. All met at Forty-Mile Peg for dinner.

All freight used to be trans-shipped from Beira to Fontesvilla with lighters, up the Pungwe River. Since August, 1896, the road has been completed between these two points, a distance of 37 miles. All freight is now carried by rail. The line crosses a level plain, commonly called the Pungwe flats, from Beira to Chimvu Hills, a distance of about 70 miles. This whole stretch of flat country is entirely inundated at times during the rainy season. Much of the track and roadbed has been washed away several times. These annual floods are one great cause of that terrible fever that is so prevalent in that region. The water becomes stagnant and evaporates, which causes a sickening miasma to exude from the ground. Grass grows from 10 to 12 feet high—in many places 15. When this rank, dense growth of vegetation begins to decay, there is usually enough malaria for all hands. Another form of sickness, known as the black-water fever, which is very prevalent near the Zambesi River, now and then claims a victim along the Beira line. It does not, in most cases, aggravate the patient long. Four to six hours is about the limit of time; that is the end of fever and patient. Very rarely one escapes. Yellow Jack is not in it.

The road was turned over last November to Mr. Geo. Pauling & Co., with Mr. A. J. Lawley as general manager, for a period of two or three years, in which time they expect to complete the road to Bulawayo. The line as far as Umtali is 2-foot gage; from there it will be 3-foot 6-inch gage. The narrow-gage part of the road is 30-pound steel; the broad-gage will be 65-pound steel.

In January, 1897, there were fifteen engines in service; now they have about forty, 13 x 20 inches, about 15 tons weight when equipped for the road. They are good engines for their size, and do a great deal of work. Wood is mostly used for fuel, except on heavy grades, a little coal is used. There are large forests along the road, so there is no difficulty in getting plenty of good fuel.

Machinery is generally very badly used; first, because so many men get jobs as engine drivers who never even fired an engine; and again, on account of so much fever and sickness, men are continually changing. A man who understands his work as a railroad man, is kept on an equality with those who know scarcely anything about railroading. Efficient men are in many cases discharged on the strength of a report from some drunk, who makes it his business to exaggerate some trivial thing unconnected with railroad duties; and it seems that special pains are taken to weed out men because they have learned something about railroading in other countries.

In proof of these statements, I will cite one case in particular. An American—commonly called "Yanks" here—was discharged (no cause given) who had been one of the most successful men on the road, never having done a sixpence worth of damage, and always giving strict attention to his duties; and I may add, he was no boozer. When the man drew his pay, the master mechanic said: "I am sorry to loose you, but I must pay attention to what others say." Of course the supposition was that he was dismissed from the general office. This idea, however, was dispelled a few days later, when the general manager asked the man why he left the service of the company.

A number of others were treated in like manner. It was a common saying then that the road would soon be minus every man who had ever seen a railroad or locomotive before coming on the Beira. Such a course of action seems strange on the part of a general master mechanic of a new railroad, whose object should be to get the best and most efficient men obtainable; especially when a company is under such heavy expense for importing men as the Beira Railway Company certainly must be. Their annual unnecessary expense must be enormous on account of the policy pursued.

Last November, when Pauling & Co. took over the management of the road, a number of the general staff and about 160 men for different branches of the service were brought out from England. Two stipulations of their contracts were, a house and servant, free. This consisted of a corrugated iron room, 10 x 10, on stilts about four feet from the ground, and a raw Kaffir, clad in the irreducible minimum of clothing. A certain amount of their monthly pay was to be held for their fares from England, and at the expiration of their three years' contract it was to be returned, and their passage paid to England. I do not think the company agreed to buy coffins for these men, but that is what they had to do, as about 60 per cent. died from fever and dysentery. Many headed back for old England as soon as they could get money enough to get them out of the country, and about twenty remained in service last April.

Soon after the arrival of these men, the hot, rainy season set in, and those robust, full-blooded fellows could not begin to stand the severe summer climate. They died like poisoned rats.

In April I came down to Durban, Natal, on the same steamer with the traffic manager and about a dozen of the road men, all—myself included—dragging our attenuated carcasses—a mere rack of bones—to a healthier clime. On leaving Eng-

AFRICAN ROLLING STOCK.

land, many thought, by the terms of their contract, they had lucrative positions; but when they learned the actual state of affairs, one continuous round of camp life in one of the deadliest fever-infested regions on the globe, and their £30 per month, the purchasing power of which is not equal to £10 in England, the majority concluded they had no sinecure.

In 1896, there were quite a number of Americans on the Beira line; only one or two remain. The assistant general manager said he wished they had more "Yanks."

Again let me cite a case or two to make good my statements. There seems to be no discrimination between serious and minor offenses in the mechanical department.

As we all know, drunkenness is considered next to, if not, a crime on railways in the United States of America. Here it is not so.

A driver was pulling a trainload of soldiers and horses. At Forty-two Miles he ditched his train, damaged his engine considerably, killed several horses, and injured a number of soldiers. One of the officers of the troops went to the engine and found the driver so drunk he could scarcely stand up. The officer was heard to say, if any of his men were killed he would have the driver shot, then and there. Fortunately, none was killed.

Another time, later, I saw the same driver, at Forty Miles, lying on the ground beside his engine, so drunk he could not walk, and was unable to take his train from there until three and one-half hours after dinner. He had another serious wreck before he was discharged; he was finally discharged by the general manager.

I saw another wicked tail-end smash-up about August, 1896, at Sixty-six Miles. Lambert, who had been a Cape policeman (Full Stroke Lambert was his proper name), was driver on first train; and Stark, a fairly good engineman, following as second section. The wreck occurred at the bottom of two inclines. Lambert made a swift run down the hill to get up the other side, but hung up for want of steam. After getting sufficient water and steam in his boiler, he could not start his train. Without giving the guard time to get back far enough to flag the following train, he went back to the bottom and part way up the other side, to get a good start. No flag out far enough, and the following train, making a run for the hill, dashed into No. 1 at the foot of the inclines, pulverizing both trains and engines. Lambert was fined £25 and discharged. Mistakes and experience in railroading are generally expensive, and somebody must pay for them.

Again, an Italian, who had fired about five months on the Netherlands Railway, in the Transvaal, came on the Beira as a driver. He used to get over the road some way, I do not know exactly how. But one day, while coming down from Chimoio with a light train, he lost a pair of back-end main-rod brasses. He walked back 4½ miles before he found them. I disbelieved the report at first, only to have my doubts removed later. He followed me to Eighty Miles one day, as No. 2, second section, arriving at 9:30 P. M. About fifteen minutes after his arrival, the night watchman, who was a kind of general factotum of the place, called me out and showed me that both right back-end main-rod brasses were missing. The watchman walked about 1¼ miles from the station before he found them. How is that for railroading?

In July, 1896, two opposing trains met on main line at One Hundred and Eight Mile tank. Up train men, who were supposed to have right of track, asked down crew what they were doing there, so they produced their orders. Up-train then backed down to One Hundred and Four Mile siding, where orders said they should meet in the first place. A serious collision was averted, as they met on straight, level track. Had they met a mile farther either way, there would undoubtedly have been a proper pile-up. Inquiry proved that Mr. Ross, station master at Eighty Miles, had forgotten to give up-train their orders, in face of the fact that the crew had asked him if there were any orders.

In September, 1896, when British Imperial troops were transported over the road for Mashona Land, an army officer, on arriving at Eighty Miles, wanted to despatch an important message. The same Mr. Ross was so affected with Scotch tangle-foot, he could neither send nor receive a message. The officer at once called for a telegraphist from the rank and file of his men. Three stepped forward and volunteered to operate the instrument. The station master was promptly dismissed by the general manager on receiving this information from the officer. However, Mr. Ross was again in service on the Beira Railway last April.

We used to pull two trains double header from Eighty Miles to Chimoio, two guards each. One hand brake and the two engine brakes constituted our braking power for fourteen loaded cars; few brakes enough, under the best of circumstances.

I was coupled ahead one day, and Driver Blagg next the train. After leaving One Hundred and Eight Mile tank, I noticed the driver behind me stagger on to the boiler head. I should have stopped, but took no heed, and thought perhaps he would straighten up long enough to get to Chimoio, distant only about seven miles. When we got to the summit of the last heavy grade, he was fast asleep, and did not shut off steam. I repeatedly whistled for brakes, but neither driver nor fireman shut off steam or applied their brake until the train was beyond control. The fireman was a new man, and out on his second trip. However, a heavy downgrade before us, on a 2-foot gage, and not half sufficient braking power behind us, was no joke for me just then. The track was in excellent condition, or we would certainly have been piled up in a dead heap. We got to Chimoio safe, but our escape seemed miraculous. The despatcher ordered us back double-header. I told the station master my bones were worth more to me than my job, and would resign rather than return with two engines coupled. I returned to Eighty Miles; Blagg remained in Chimoio all night.

He took offense, when accused by the station master of being drunk. He had two serious wrecks before being discharged. After dismissal, and a big booze, he went on the road again as fireman.

I merely cite these cases to give an idea of what railroading is like on the Beira. I have often wondered what some of our superintendents and master mechanics would do—especially some of our great disciplinarians—if they had such material for road work. I venture the assertion that many would become gray haired in a single night. The Grievance Committee and the kicker are unknown in this country, I may say on this continent. Railway officials in the United States of America, however, should be pleased and thankful to have a class of men in railway service who have brains enough to kick and intelligence enough to present a grievance. It seems to be a kind of natural privilege granted to those who know at all times just what they are doing; hence the great number of railroad men in the States known as cranks and kickers. So far as my experience goes, our railroad men in the States, especially our enginemen, stand second to none in the world.

Last November, when so many men came on the Beira line, a series of wrecks occurred, to which, for bluntness, there is scarcely a parallel in the annals of railroading. No. 1 and three sections following, all about twenty minutes apart, came together at Seventy-two Mile tank. First train stopped for water. The tank is at the bottom of two five-mile inclines; second train dashed into first at the tank; no flag out; and third train ran into second because the driver could not see the train when coming around a curve. Fourth train piled upon the first three, because the driver could not stop, although a flag was sent back from third train. Except first engine, all trains and engines were completely wrecked. This is only one instance of the many smash-ups that happened about that time.

Pay.—We used to get one pound sterling for 80 miles, or ten hours, and over time. Since about last January the mileage has been increased to 115 miles for a day's pay, £1, and no over time. Thus if it takes eighteen hours to run 115 miles, only one day's pay is allowed. A bonus of £5 is given if the drivers run a whole month without any mishaps, which, in ordinary course of events, is rather improbable. Enginemen must work hard to get £25 per month, which, considering the cost of living, the climate and country one has to live in, is extremely small pay. Guards receive from £20 to £22 10s. per month.

P. H. Stellwagen.

Johannesburg, S. A. R.

Curious Breakage of Crank Pins.

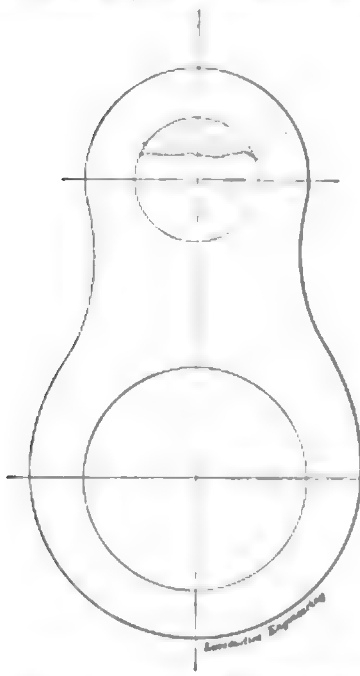
Editors:

Three main crank pins have been broken off of three engines, 19 x 24-inch hogs. The peculiar part is that each pin was cracked opposite the main center, as the accompanying cut shows. This will be a good subject for the readers of LOCOMOTIVE ENGINEERING to consider and answer, naming the cause for the break, which is shown in the shaded area.

L. M. COOLTON.

Eagle Grove, Ia.

[Here is an opportunity to enlarge on the numerous causes likely to produce



CURIOUS BREAKAGE OF CRANK PINS.

fracture in a main pin. Our correspondent does not say what part of the pin was affected, but it is assumed to be near the hub, the point of greatest stress.—Ed.]

Change Location of Classification Lights.

Editors:

The classification lights usually located on the front end of an engine are often a source of danger, owing to the liability of being extinguished in very strong winds and being obscured in heavy snow storms. They are often, also, hardly discernible on account of the lamp smokingand covering the glass on the inside with smoke and soot.

It seems to me a much better place for them would be in the upper forward corner of the cab, as here they would have the protection of the cab, would be convenient for the engineman to light, and while in use, would act as continual reminders to the engineer that he was carrying signals, thus lessening the liability of his failing to call the attention of other trains to them.

My idea would be to have the lenses properly made, so as to emit as much light as possible, to have one lamp serve for both lenses on one side, and behind the lamp to place a reflector of some sort, so as to intensify the light.

If placed in the cab, they could be plainly seen, easily lighted without delay or annoyance in all kinds of weather, and should one go out or commence to smoke, it could be noticed and attended to without stopping or waiting until arrival at next station.

Moreover, the anxiety felt by an engineer as to whether his signals are burning or not would be removed, as he could see both sides of the cab from his seat.

The use of the reflector would make the lights much more distinct at night, and in foggy weather and during the hours of twilight and dawn, when both flags and lights are most likely to escape notice, they could easily be distinguished.

J. P. KELLY.

33 *River St., Pittsfield, Mass.*

Help in Lighting the Headlight.

An engineer in Holyoke, Col., who is too modest to have his name mentioned, writes:

"I noticed an article in your paper of this month about the difficulty in lighting headlights in windy weather. As this section of the country is noted for high winds and blizzards, we as a rule would get in front of a station or coal shed, as the case might be, for protection.

"On several occasions it was necessary to put a white light on reflector, as the winds were too strong to light the headlight. I split a stick about 10 inches long, made the match wedge shaped, opened the door just enough to get my arm in, struck match on the inside of casing and lowered it down to wick through the chimney without removing chimney. Try this."

Passing of the Plain Tire.

The flangeless tire is, without doubt, one of the toughest of the old legacies left us by the early builders of the locomotive. It has made a game resistance, so far, against displacement, except in a very few cases; but those that have abandoned its use have done so with a full knowledge of both sides of the question and a determination to make the leave a permanent one. There have been no more bitter side-talks, that we can recall, on any one detail of the locomotive, than on the expediency of banishing the plain tire from an engine; its friends always had a chip on both shoulders.

It is a significant fact, however, that there is to-day not a very great unanimity of purpose as to the best location of the plain tire on ten-wheeled engines. Some people insist that it should be on the front wheels, and thus practically make the engine an eight-wheeler with reference to curve resistance, while others contend that it should be on the middle wheels for safety. This disagreement in so important a particular seems to inject an air of weakness in the contention of the pros, and full advantage of that fact is taken by anti's.

Among those who have successfully discarded the plain tire is Mr. J. H. McConnell, superintendent of motive power of the Union Pacific. All tires on that system have flanges, no matter what the type of engine. The question of lateral motion, to prevent flanges binding on curves, is solved by placing the front tire on ten-wheelers toward each other an amount that will give ample clearance at the rail, and at the same time allow the flange to clear at frogs and guard rails. The same result is accomplished on six-wheeled switch engines by putting the middle tires in toward each other. The flange clearance is not excessive in any case, and the same is true of flange wear; while there is certainly a saving in the item of tires to be carried in stock by the new system.

The Race Problem on Southern Roads.

In some sections of the South it has been the practice for years to run cars for the exclusive use of the negro patrons of the roads. The roads in North Carolina, however, have never fallen in line with this policy, notwithstanding the popular clamor of the whites, dating from the close of hostilities between North and South for separate passenger accommodation. The conservative management of these roads has so far prevented any action in satisfaction of the demands of the people until at this time. There is now every prospect that the agitation due to the recent race troubles will crystalize in action that will give a separate service. The Railroad Commission has had the matter in hand, and the Legislature at its coming session in January will no doubt make due provision in the regular way to give a service that will keep the colored contingent by themselves. The question of separate waiting-rooms in the depots will also be passed upon, and the isolation of the negro from his white brother will be complete, as far as legislative enactment can make it so on a railroad.

Our edition of "Helve Hammer in the Blacksmith Shop" is now no more, and readers who are interested should write to the Bradley Company, Syracuse, N. Y. They have a few which they will send to those who apply within a reasonable time.

A report is in circulation that a syndicate, headed by Joseph Leiter, of Chicago, has bought the Rhode Island Locomotive Works, and that the intention is to equip them for the building of compressed air motors. It is also said that the syndicate has secured from the American Air Power Company control of the Hoadley-Knight compressed air patents.

The Etiquette of Smoking in Foreign Railway Trains.

On English trains one may smoke only in such compartments as are marked "Smoking." This system is also found in France, but there the more general custom is to allow smoking in all compartments not marked "No Smoking Allowed." This last system prevails upon the Orleans Ceinture line, and worked all right till a few days ago, when a serious flaw was discovered. A French woman named Mlle. Viron got into a compartment marked "Ladies Only." Here she was joined by another woman, whom she did not know, but who proved to be a real Russian Countess. After a little while the Countess produced a cigarette case, lighted a thick cigarette, and proceeded to smoke. Mlle. Viron began to cough, and somewhat testily asked her companion to stop smoking, saying:

"You see it inconveniences me, and it is not allowed in this carriage, which is marked 'Ladies Only.'"

The Muscovite lady smoked more vigorously than ever, remarking that, as there was no notice in or outside the carriage to prevent her smoking, she was determined to finish her cigarette. Mlle. Viron retorted by calling the Countess a bad lot. This was too much for the Russian. Oblivious of the Franco-Russian alliance, and without any formal declaration of hostilities, she attacked the French woman, and apparently gained a decisive victory. With true womanly instinct she grabbed the French woman's hat and took some hairs along when she pulled the covering off her adversary's head.

When the train stopped at the Orleans Ceinture station, Mlle. Viron, with her feathers considerably battered and her hat very much distorted, fled from the field of battle and sought assistance from the stationmaster.

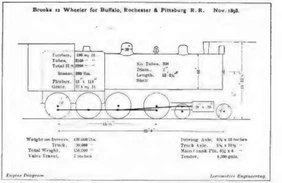
He immediately called upon the Russian Countess to abandon her cigarette, but she again pointed out that there was no notice anywhere to forbid her smoking, and went on puffing spirals of smoke into the faces of the stationmaster and guard. The latter, either warned by the fate of Mlle. Viron or afraid of international complications, abstained from violence, and the matter is to be referred to arbitration—in the law courts.

Standard Bolt Heads and Nuts.

It is a strange commentary on our boasted love for standards to see a circular of inquiry from the Master Car Builders' Association the purpose of which is to know *what* standard is followed in the manufacture of square head bolts and nuts. This is a subject we ran afoul of several years ago, and in our innocence attempted to bring order out of chaos on a certain railroad in this matter. We were rewarded with ignominy for our pains. The manufacturers would not at that time fill an order for anything not on their lists, and as our schedule was arranged with the one view of cutting off the trials attendant on a further use of their freak sizes by adopting the Sellers standard, the whole thing was turned down. We are glad to see this matter coming to the front with a prospect of settlement by the people most interested. There never was any good reason for the continuance of the so-called manufacturers' standard, and the sooner it is wiped out of existence the better and cheaper it will be for railroad companies.

The Dodge Kinetic Motor Company, of New York, who control patents for motor purposes by means of charged boilers from a central plant, are after their friends the electric people, in which the latter are invited to prove the motor (recently illustrated in these columns) inferior to the electric article. In the event the electric contingent performs this feat, the motor people engage and promise to give up a quantity of coin quite equal to a prince's ransom. While we do not believe the party of the second part will make an effort to land the prize, it seems at this distance as if it would be a good thing for the motor promoters if they would give the public some authentic figures on the cost of running their device. That's what capitalists are interested in, and that is what will decide the fate of it.

OFFICERS' INSPECTION LOCOMOTIVE.



The Q & C Company have issued a very complete catalog of their pneumatic tools and it contains much information of value to railroad mechanics. They are prepared to install complete air plants from the compressors to the tools which will save much detail work for the purchaser, and be more satisfactory than buying piecemeal. The catalog shows tools at work as well as their construction. Some of the views are good object lessons. Their address is Western Union Building, Chicago.

Improved Air Tools—Union Pacific.

The Union Pacific road has earned the reputation of having been very early in the field of air appliances and of a most extended use of them. That this repute is well deserved is cheerfully conceded by all that have a chance to witness the working of the devices Superintendent of Motive Power McConnel has installed in his shops. Among the new ideas worked out for using air are improvements in tools for air-hose accessories and fittings, distinct and apart from the well-known devices for forcing such fittings into hose; of the latter nothing need be said other than that there are no better, but the new tools are worth illustration.

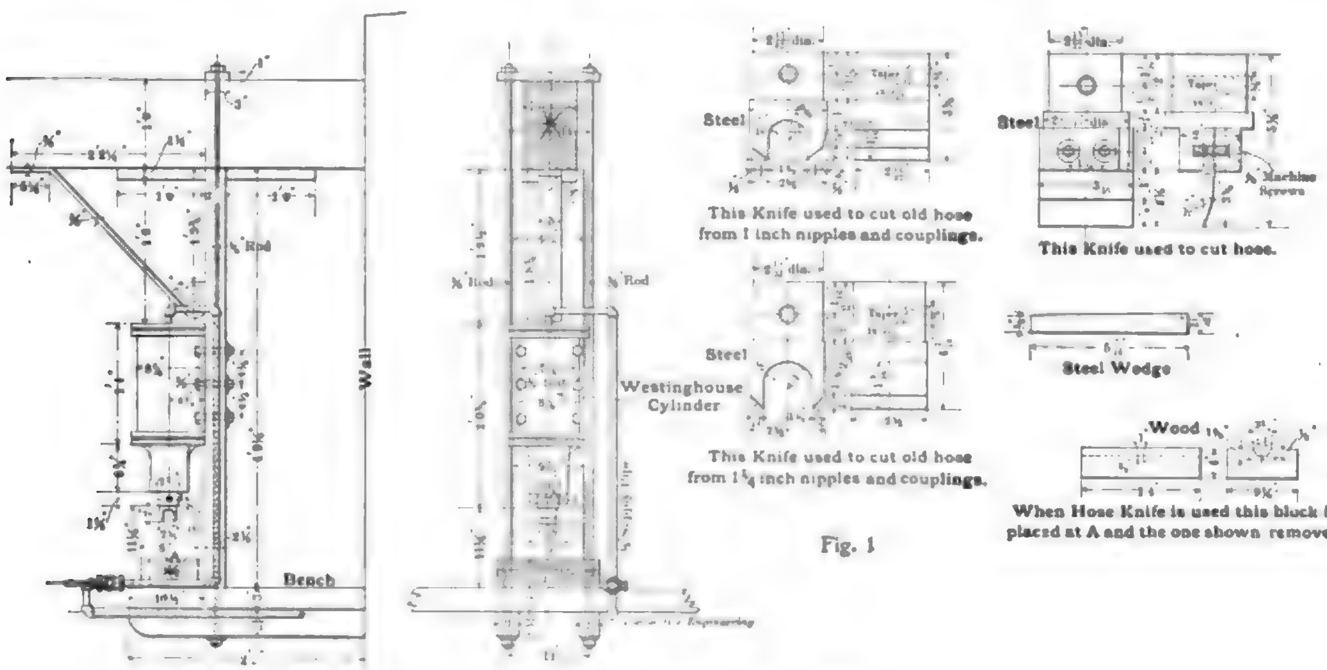
As everyone who has kept in touch with the hose-fittings question knows, the expense involved in the removal of those fittings from old worn-out hose for future use in new hose, is a heavy item in renewal cost; to reduce this expense was the object of these improved tools. The engravings in Fig. 1 embrace the cylinder and knives used in cutting old hose from nipples and couplings. The knives have a width between cutting edges which is practically the diameter of the neck of fitting in the hose, so that when forced down on the hose, the latter is cut to the metal and freed at once.

A shear for cutting hose-clamp bolts is shown in Fig. 2. This arrangement was devised to avoid the slow and exasperating job of removing the nuts of these bolts, for they were invariably rusted on, and the expense of removal was greater than the cost of a new bolt. Right here is found a neat little adaptation of means to ends by removing the screw of a bench vise and connecting the movable jaw to the piston of an air cylinder. To the shank of this vise jaw is bolted one leg of the shear, the other being left free to work against the stationary jaw of the vise. This idea is also utilized for applying hose clamps, as shown in Fig. 3, where the auxiliary vise for forcing and holding the clamp into position on the hose is shown between the jaws of the larger vise.

One of the last places, probably, that results would be expected from compressed air is on the output of a nut-tapper, but it is a fact that the capacity for work can be, and is, increased by its use. It is well known that a nut-tap becomes badly dulled on the first threads entering a nut, while the following or sizing threads are unharmed, due to the duty imposed on the entering end of the tap being forced through the hard scale, which, after removal, leaves little work for the tap to do. It is also well known that a tap having its first threads badly worn is hard to start in a nut, and requires more muscular effort than the attendant is willing to part with. In any event, the starting of a tap under these conditions is a matter of time, and to reduce it to its lowest terms a hollow air piston, as shown in Fig. 4, was placed in alignment with each tap on the machine. The admission of air above these pistons sends the nuts down on the taps and leaves the operative with a reserve of energy to be utilized in placing nuts on the taps. It pays, for the reason that no time is lost in getting a tap at work in a nut.

These machines, it is seen, are no makeshifts; but there is one—the peer of them all—that we are unable to illustrate, for the reason that no drawings have been made of it, and a paretic camera would not reproduce it. Reference is made to the machine for drilling staybolts. This little machine is entirely automatic in all of its functions after air is turned on. The vital parts are: A pair of cylinders side by side horizontally, that have a clamp on the outer ends of the pistons, which hold and advance the bolts against the drills. The ends of the bolts in which the drill is operative are held in a centering clamp, which keeps them in correct line with the drills. Twist drills are used, and the feed of the bolts against them is done entirely by means of air pressure on the movable pistons which grip the bolts. Very few drills are broken under this automatic feed with an output of over 800 bolts per day.

It must be apparent, then, that there was some good headwork involved in designing those pistons to give a maximum pressure against those small drills (about 3-16 inch) so as to be safe against rupture by clogging. It is one of the prettiest tools we have ever seen, but must be caught at work to be properly appreciated.



CUTTER FOR REMOVING HOSE FITTINGS.

We are informed by the Lima Locomotive Works that their shops are running thirteen hours a day, and they have five 50-ton Shay locomotives, two 17-ton Shay locomotives and one 20-ton Shay locomotive to build. They also have twelve mogul engines to rebuild for the Detroit & Lima Northern Railway Company.

Messrs. Stannard & White are congratulating themselves on having received two fair-sized orders for their cab seats from the Baldwin Locomotive Works. This indicates that the comfort of enginemen is being considered, and is a good sign. We should like to see all locomotives have this seat.

Jim Barlowe.

BY F. M. NELLIS.

There, in my office doorway, tall, dark and slightly stooped, he stood, his old, soft, felt hat curled into a roll in his left hand, which dangled aimlessly at his side, while the right clutched a letter and nervously stroked a long, straight, drooping, black moustache. The ill-fitting, rusty black clothes hung from his gaunt figure, and suggested long and hard service, as I turned from my desk to receive the letter which he thrust towards me. I opened the letter and read:

"DEAR TOM—The bearer, Jim Barlowe, is not a sober, industrious man; is not a loyal, faithful fellow who would give you good service; but is a worthless, good-for-nothing chap. He gets drunk, and isn't worth a d—n; but he's a relative of mine, and I wish you would put him to work. (Signed) JOE."

"My old chum and shopmate is candid, at least," I mused, as I rang up the foreman and told him to find a place for Jim Barlowe, whose last job, so he told me, was driving a horse car.

Next day I saw the tall, dark, rusty-coated figure driving the old grey horse which carted castings from the foundry to the machine shop. I saw him frequently afterwards, and wondered just who he really was, and what had been his occupation in better days.

One day a strange man drove the grey past the office, and I asked the foreman what had become of Barlowe.

"Fired him," replied the foreman. "Couldn't stand prosperity. Got drunk. He's in the hospital now with tremens, so Barney Connor, the molder, tells me."

And so it proved. A few days later we learned of poor Barlowe's death, and also the sad life of the unfortunate man.

James Barlowe, in his youth, was as popular and clever a boy as there was in Dennison, O. As a machinist apprentice and locomotive fireman he even excelled the popularity of his boyhood days. No dance, party, or musicale was complete without happy, dashing "Jim" Barlowe, and many a party was timed to suit Jim's run.

It was Jim Barlowe's cool, daring skill that drove the "limited" through the fog over the crooked single track of the Panhandle road on time, and made the man popular with his associates who always had a cheer for him as the "900" tore past.

Many a night the "900" stood under the brilliant electric lights in the Pittsburgh Union Station awaiting the midnight express from the East, as the traveler stopped and shook hands with Jim, or called cheerily up the gangway to him in the cab in the familiar way which delights the heart of the wide-known engineer.

But big, handsome, lovable Jim Barlowe was not to remain a hero, enshrined in the hearts of all who knew him. He was to pass from the life of the youth who idolized him, the associates who loved him, the traveling public who worshiped him. The temptation came, was too strong for Jim Barlowe to resist, and he fell. The story is told.

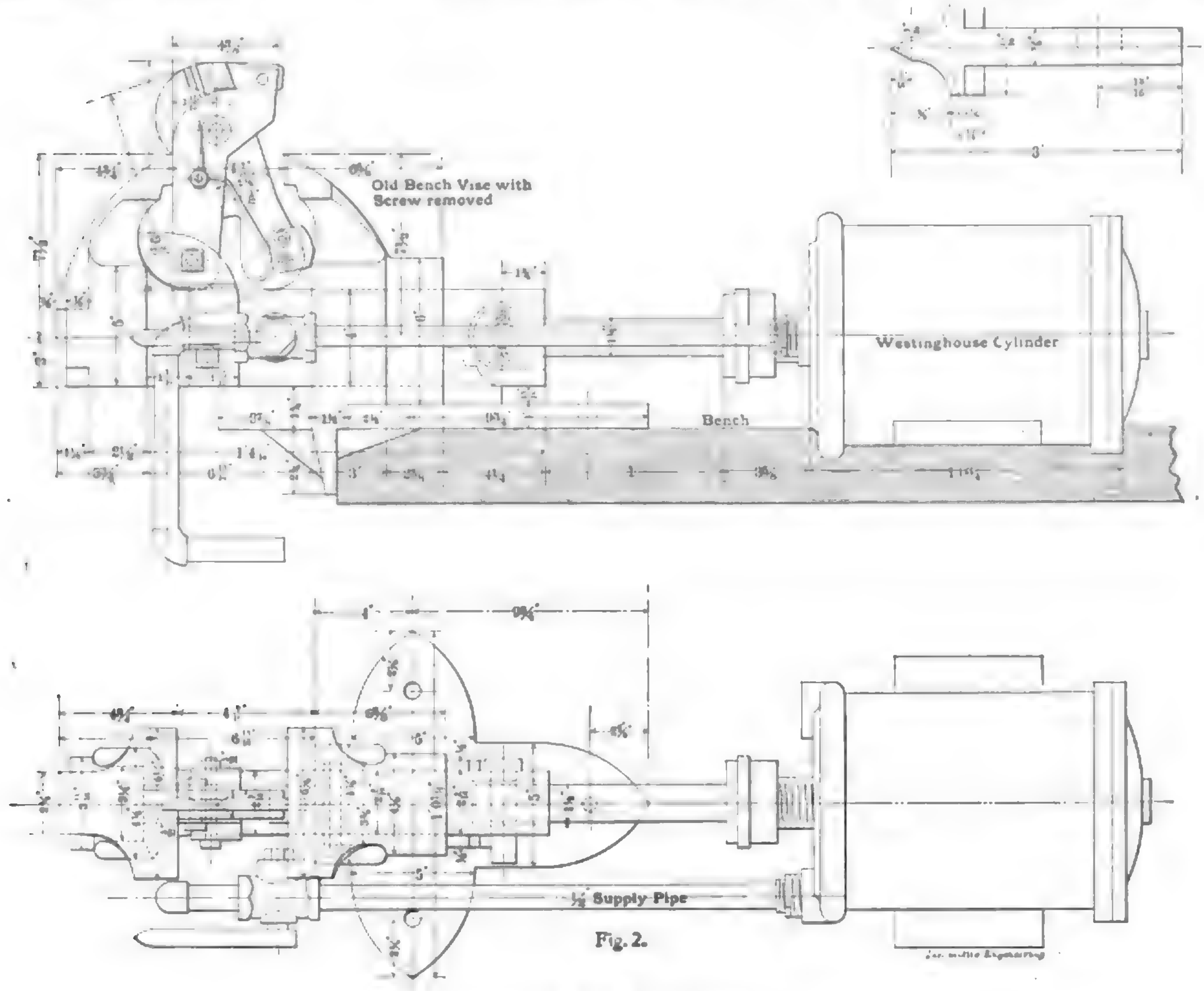


Fig. 2.

SHEAR FOR HOSE CLAMP BOLTS.

Armstrong Bros., of Chicago have already entered the field in Cuba. Last month they made two shipments to that country. They have also received orders from Russia for 435 sets of their tool-holders and 435 3-feet bars of their steel.

Rules Made to be Broken.

There are a good many railroad companies in America that keep rules that are merely employed to discipline employes when an accident happens, but are not intended for use in daily practice. For instance, the rules of certain roads require trainmen to pass through all stations and yards at a low rate of speed, but the engineer will be punished if he does not make the schedule time, when everybody knows that it would be impossible to slow up at every station and make the running time. This country does not enjoy a monopoly of this kind of injustice. In a recent issue of the *Railway Times of India* we find the following item:

"The railway authorities have a certain rule which forbids a guard attaching more than twelve carriages to his train, and if he does so, he is liable to be dismissed. By a strange law of providence if he does *not* do so, he is liable to be suspended. An instance of this can be found in the annals of Southern Mahratta history. The unsophisticated outsider smiles and wonders how things are worked on the S. M. Railway."

Tools Cracking on the Grinder.

A case has come to attention recently, in which a tool-grinder from one of the most reputable builders of those machines, has developed a faculty of cracking tools while being ground. The reason for this behavior is not clear to those who bought the machine, as they are running it in accordance with the formula provided by the builder. To a man who does not know anything about it, the case is easy of solution, for every evidence points to the emery as being too coarse, and therefore puts too many heat units in the tool. The stream of water coming against the cutting edge of the tool at this time finds every condition ripe for the rupture that ensues during the passage at arms of the elements. It does not make any difference what the kind of steel, Mushet or otherwise, the cracks show up just the same. What makes the case a mysterious one is that the wheel is the builder's choice for the work.

Schenectady Compound Locomotive.

NO. 1 OF THE COMPOUND SERIES.

This is of the two-cylinder type, and the first one was built in 1890, under patents granted to Albert W. Pitkin the year previous. There have been several changes since the first engine, such as were suggested by experience, and the charts show the latest style, which includes a reducing valve, for running simple, and places the compound feature under control of the engineer. The first ones went into compound automatically after the receiver pressure reached a certain point.

With the engine hooked on to a train ready for a start, the engineer opens a small cock in the cab, and steam (or air) flows through the small pipe shown vertically at the front of the intercepting valve, and forces the small piston back, opening the valve shown and opening connection between the receiver passage and the smaller annular port just to the right of it. This establishes a free exhaust for the high-pressure cylinder, and enables the engine to work simple as long as desired. The steam enters high-pressure cylinder, exhausts over through the receiver and escapes to exhaust pipe when the right-hand valve is open, as shown.

The steam for the low-pressure cylinders comes direct from boiler through pipe at left, which is plainly marked. This enters the chamber around the intercepting valve, forcing it against its seat and opening a passage for live steam through reducing valve to low-pressure steam chest. This valve reduces the pressure sufficently to have the low-pressure cylinder do the same work as the high.

After the engine is fairly under way, and the engineer wishes to throw it into compound, he closes the valve or cock in cab, shutting the steam out of the small cylinder at the right. The spring forces the valve to its seat and prevents the exhaust from the high-pressure cylinder escaping through the annular port to the exhaust pipe. As it cannot escape, it accumulates or "banks up" in the receiver, and when of sufficient pressure, forces the intercepting valve to the left into the position shown in the "compound" view. This prevents the live steam entering low-pressure cylinder and leaves the engine with the live steam going to high pressure cylinder only, and the exhaust from the high going to low-pressure steam chest.

When the engine is shut off, the receiver pressure drops, and the live steam in low-pressure steam pipe forces the intercepting valve to its first position, ready for another start.

When starting the engine compound, the cock in cab is not opened, and the exhaust valves remain closed. Steam entering the chamber around intercepting valve pushed it to its seat, permitting steam to pass through reducing valve, same as when starting as single expansion. When the pressure in receiver is sufficient, the intercepting valve will move back and the exhaust from the high-pressure cylinder to the low-pressure steam chest.

The large piston at the left and the small one inside the reducing valve are dash-pots for reducing shock from sudden movements.

This brief description, together with the information to be obtained from the letters written by engineers handling these engines, should aid greatly in securing a clear idea of the workings of the Schenectady compound locomotive.

How They Handle the Schenectady Compound.

Mr. James Burke, of the Northern Pacific Railroad at Mandan, N. D., writes:

"In looking over the engine before starting out, look for loose eccentrics, rocker boxes and broken frame bolts on high-pressure side.

"In starting, work it simple until train is moving five or six miles per hour. In this way you can start a heavy train readily, as live steam is being used in both cylinders. When nicely started, cut in the compound. This will also avoid jerking or breaking train in two.

When running, always work the engine compound (except in extreme cases, to prevent doubling a hill or stalling), as they are more economical when run in this position.

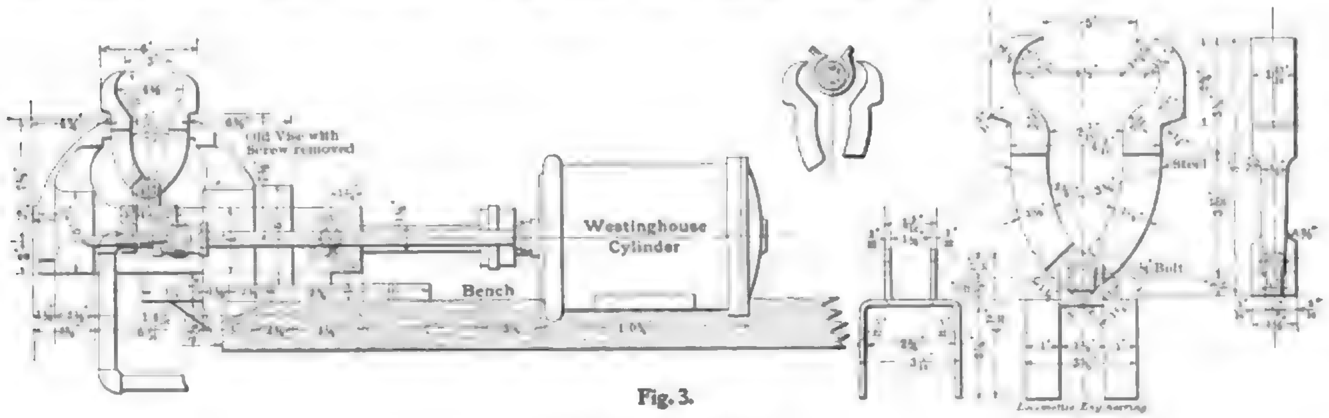


Fig. 3.

VISE FOR HOSE CLAMPS.

"In switching, taking engine in and out of house or reversing, always run them simple, as they seem to clear themselves better and handle better. As to firing, we get best results by firing light and regularly.

"In oiling cylinders and valves with Detroit lubricator having the force feed (Tippet attachment), shut the plug of blower tight on low-pressure side and leave it wide open on high-pressure side. If both are left wide open, all the oil will feed into low-pressure cylinder, on account of being so much less pressure to feed against.

"If high-pressure cylinder becomes disabled from any cause, so that it becomes necessary to disconnect that side, push the valve clear ahead and clamp stem far enough to clear exhaust port; also block cross-head to front of guides and work engine compound. This allows steam from main steam port to pass through exhaust and into low-pressure cylinder through the receiver. This gets the most work out of the engine, as the low-pressure cylinder receives full boiler pressure.

If low-pressure side becomes disabled, so it is necessary to disconnect that side, clamp the valve central, covering all ports. Block cross-head back. Cut engine into simple. This will open special exhaust in receiver and allow steam that is being exhausted from high pressure to go direct into stack.

"If air pump becomes disabled, so you have no pressure to hold special exhaust in receiver open, clamp low-pressure valve clear back, far enough to clear exhaust port and work engine compound. This will allow exhaust from high-pressure cylinder to pass through the receiver into exhaust port of low-pressure cylinder and out the stack.

"If intercepting valve is disabled, clamp piston rod of valve ahead if possible. If not possible, take off back head, push valve clear ahead and fit a wooden block between valve and back head, so it will hold valve secure, then run the engine simple.

"In lubricating valves, we feed high-pressure valve from twenty to thirty drops per minute. The low pressure needs very little, about the same as an air pump."

Mr. Jas. Bruce, of South Tacoma, writes:

"I have had considerable to do with the handling of Schenectady compounds during the past year, and would handle them as follows: First, I would inspect same as a simple engine, paying particular attention to dash-pot, to see it was always full of oil, as it is liable to leak past packing at both ends, and allow intercepting valve to move too fast, and might cause it to break by striking its seat.

In starting engine, always start in simple, as a train can be started much more smoothly that way, and it prevents jerking movement that is apt to occur if started compound. If handling engine in close quarters, such as coupling on to cars or spotting on turntable, or in similar circumstances, always have engine in simple, as separate exhaust valve is then open and you have no steam in receiver to contend with and can stop so much quicker. After starting train simple, would put engine in compound as soon as I got slack out and train moving. Would run engine the same in all respects as a simple engine. In reversing, would put engine in simple by opening separate exhaust valve.

"Oiling, same as simple engine, except cylinders; high-pressure side requiring a great deal of oil, low-pressure side requiring very little, while working steam, as it gets the benefit of the oil from the high-pressure side. Feed of lubricator should be reversed while drifting, as the low-pressure side then requires the most owing to the larger area of cylinder and size of piston. Firing, same as a simple engine—light and regular, according to requirements (with bituminous coal).

"If high-pressure cylinder broke, disconnect that side, cover ports, and run in with low-pressure side. This can be done by engine in simple, or by blocking separate exhaust open. By using the latter method, you would save air that might be wasted by separate exhaust valve leaking.

"If low-pressure cylinder broke, would do same as with high-pressure, disconnecting low-pressure side. If intercepting valve broke, would take what part of train engine could handle and go in for repairs."

Mr. Wm. J. Appleyard, of Malone, N. Y., says:

"Our compounds are consolidations, the only ones of that class we have. The compounds have never been disabled, but I will describe the way I would disconnect were engine disabled:

"I examine thimble bolts, removable collars on crank pins, see that dash-pot is full of oil and other parts the same as a simple engine.

"There is no difference between a compound and simple engine in starting, except to use a little more care in starting compound, on account of the greater number of cars you are handling.

"If intercepting valve should be dry or gummy, engine is apt to start with a jump, or jerk, starting in compound, endangering draft rigging and drawbars.

"Open cylinder cocks to carry off condensation.

"There is no difference between a compound and simple engine while running. I work both where they will handle their train the best; although in a compound the

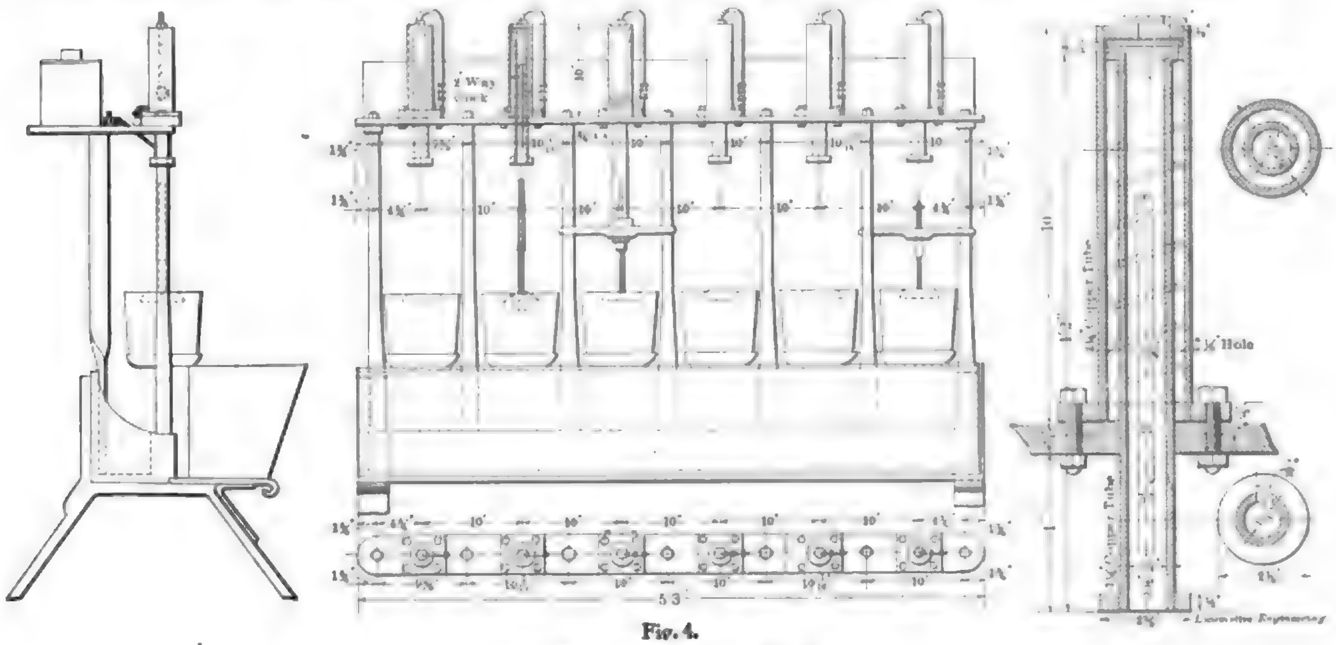


Fig. 4.

STARTING NUTS ON A TAP BY AIR.

lever will be considerably lower than in a simple engine. Open cylinder cocks frequently, especially in cold weather, if drifting down hill, keep throttle open enough so steam will show at cylinder cocks.

"I always depend on the brakes for stopping. With the same number of brakes and cars as simple engine, the compound will stop the quickest; engine appearing not to run as free as a simple engine.

"I have never had to reverse compound engine, except in shifting, and then I usually depend on the brakes, as reversing is dangerous to draw-bars and draft rigging unless handled very carefully.

"Disconnect on high-pressure side same as for simple engine. If intercepting valve is all right, it will move to simple position, opening communication from steam pipe to low-pressure cylinder through reducing valve. Open separate exhaust port or valve.

"Disconnect on the low-pressure side the same as for simple engine. Block intercepting valve in compound position, so ports in reducing valve and bush will not register, thereby shutting off steam to low-pressure steam chest. Open separate exhaust valve, and proceed working one side.

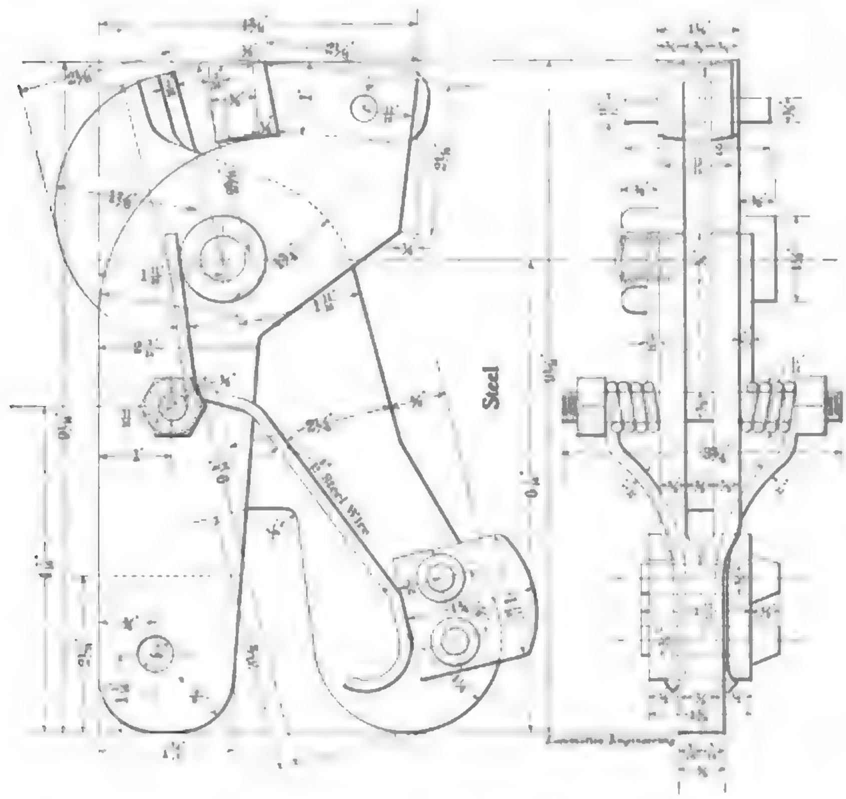
"If there was trouble with intercepting valve, would take off intercepting valve head and see what is wrong. If nothing prevented, would block valve in compound position and proceed. If it was broken so I couldn't block it in compound position, would block it in simple position. Open separate exhaust valve and proceed working simple.

"The running gear of a compound engine requires a little more oiling and looking after than a simple engine. We use valve oil in two lubricators, one for air pump and the other for both cylinders and intercepting valve, also a cup on each piston sleeve. When engine is working, I give high-pressure cylinder about twice as much oil as the low-pressure, and intercepting valve about the same as low-pressure cylinder.

"I have taken the performance of a simple and compound engine from one of our performance sheets, as a comparison between the two engines on oil:

"Mogul engine; weight, 110,000 pounds —Miles per pint, valve oil, 86.02; miles per pint, engine oil, 46.96; average all lubricating oils, 30.38.

"Compound consolidation; weight, 153,000 pounds—Miles per pint, valve oil, 48.30; miles per pint, engine oil, 29.56; average all lubricating oils, 18.34."



DETAIL OF SHEAR FOR CLAMP BOLTS.

Mr. D. L. Mahoney writes:

"Know that the intercepting valve and other enclosed valves are working 'O. K.' Other parts are looked over same as simple.

"Do not start engine with wide-open throttle, but open gradually with cylinder cocks open. When steam is working dry out of low-pressure cylinder, close cylinder cocks and adjust throttle valve. I run with lever about one-third stroke, and throttle valve adjusted to suit train as the occasion demands.

In stopping, commence in time to ease off gradually on throttle stop with the brake. When running at any speed, do not reverse engine to stop; use the brake.

"Disconnect high-pressure side same as simple engine; but if the valve leaks on that side, open separate exhaust valves and block intercepting valve ahead. Do the same on low-pressure side if it breaks down, but open separate exhaust valve and block intercepting valve back. If there is a break in intercepting valve, it depends how it is disabled. If so as it will not work in compound, try simple.

"They need more oil than simple engines. Would say to give them 2½ pints valve oil for 100 miles."

Curious Railroad Rules in Turkey.

There are some curious features about the laws regulating railway operating in Turkey. The law requires railroad companies to provide for the families of persons who are killed on their lines by accident, and those who are injured receive compensation to cover their board, medical attendance and loss of wages as long as they are unable to pursue their accustomed avocations. At the same time there is a penalty of $1 for walking upon a railroad track in Turkey for every offence. Cattle and other animals found on the right of way of railroads can be confiscated by the company, although the owner may redeem them by paying 25 cents each for sheep, dogs, goats, hogs and other small animals. It costs $2.50 to get a cow or a horse out of a railway pound. Animals that are not ransomed within a given time are sold at auction for the benefit of the railway company, which, however, must return to the owner any sum in excess of the fine imposed by law and the cost of keeping the animal while in charge of the company. All articles left by travellers in the cars or in the station houses are also subject to similar rules. They can be redeemed upon the payment of a fee, and at the end of a certain period all articles not redeemed are sold for the benefit of the company.

Oil on The Roadbed.

It is said to cost $150 per mile to make the first application of oil to the road-bed of the Boston & Albany, with a decrease in cost for subsequent treatment. Some of the advantages thus far apparent from the use of oil are: Less dust to encourage the hot box nuisance, and discomfort of passengers; a train seems to make less racket; track does not heave, as frost does not enter; road-bed is not easily washed out of shape, for the reason that oil leaves a crust on the surface seemingly impermeable to ordinary rains. If, as is claimed, the oil used for this purpose is non-inflammable and odorless and it does all the good things noted above, there is likely to be a bull movement in the oil market, or, for that particular oleaginous compound at least.

Southern Pacific Schenectady Mastodon

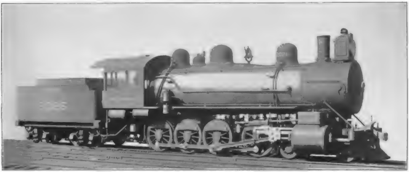
A great many of our readers are watching to see that we do not lag in the publishing procession, and they are kind enough to inform us promptly if they believe that we fail to do anything they consider desirable. This sentiment brought us a letter from the Pacific Coast asking why we had failed to write up the splendid Schenectady compound twelve-wheelers which are doing such fine work on the Southern Pacific. We lost no time in sending for photograph and specifications. Now we present an engraving of the locomotive. It is not the most powerful locomotive in the world, but all of the class give a good account of themselves in hauling trains, and do it, too, with remarkably light expenditure of fuel.

The engine weighs 192,000 pounds in working order, of which 155,000 pounds are on the drivers, which are 55 inches diameter. The cylinders are 23 and 35 x 32 inches, the ratio of high to low being 1 to 2.3. The boiler supplies steam of 200 pounds pressure, which gives the engine about 40,000 pounds tractive power. The ratio of adhesive weight to tractive power is 3.875, and the coefficient of adhesion is 0.26.

The boiler, as will be seen from the engraving, is extended wagon top, and is 72 inches diameter at first ring. The firebox is 120 3-16 inches long, 42 inches wide, and from 73½ to 77 inches deep. There are 332 2¼-inch tubes, 14 feet 6 inches long. The total heating surface is 3,025.85 square feet, and the grate area is 35 feet.

Allen-American slide valves are used, the greatest travel being 6½ inches. The high-pressure valve has 1¼ and the low pressure 1⅛ outside lap. Both have ⅛-inch inside clearance. Jerome metallic packing is used for the glands of piston rods and valve stems.

One No. 10 Ohio injector and one No. 10 Monitor are provided, feeding the boiler. Among the other attachments are three 3-inch consolidated encased safety valves; American brake on all drivers; Westinghouse air pumps, 9½ inches diameter. The Sweeney brake arrangement is on the low-pressure steam chest, and the Le Chatelier water brake on the low-pressure cylinder. The boiler is covered with Franklin "Monarch" magnesia sectional lagging.



SOUTHERN PACIFIC SCHENECTADY MASTODON.

To Fight the Express Companies.

One of the most ravenous blood-suckers of railroad companies, and of the public generally, is express companies. Railroad companies do the transportation for all the express companies, and get miserably paid for the work done. While politicians are constantly striving to reduce the small earnings of railroad companies, there is seldom a word said against the impositions which the whole community suffer from the iron hand of the express companies. This is not accidental.

We are inclined to think that, in the State of New York at least, the express companies are not going to be allowed much longer to fleece the public so successfully as has been the past practice. The Merchants' Association has taken up the matter, and intends pushing a crusade for justice. As this is an exceedingly influential organization, it may succeed in effecting radical changes on the rates now charged by express companies.

A statement issued by the Merchants' Association says: "According to the statements made in the United States census report for 1890, the express companies of the United States are capitalized for $55,000,000. Their actual investment is less than 10 per cent. of that amount. The Adams Express Company has a nominal capital of $12,000,000; its investment is $1,128,915. For years it has paid 8 per cent. on its capital stock. This is 80 per cent. on its investment. In addition it has accumulated a surplus of $15,000,000, of which $12,000,000 has recently been distributed to stockholders. The American Express Company has an actual investment valued at $1,276,619. It pays $1,080,000 in dividends annually, besides laying aside something as a surplus for a rainy day. Roundly, both of these companies earn as profits from 105 to 175 per cent. of their investment every year. The United States Express Company, capitalized for $10,000,000, has an actual investment of about $700,000. Wells-Fargo Company, capitalized for $6,250,000, has an investment of about $725,000. These companies exact from the public from three hundred to many thousand per cent. of the charges imposed by railroads for ordinary freight transportation.

"For the transportation service, the railroad companies receive on an average 40 per cent. of the total charges; for the terminal service the express companies receive on an average 60 per cent. of the total charges. It is this 60 per cent. of the total that yields to the express companies, after paying the cost of the service, an annual profit of from 150 to 175 per cent. of their investment.

"This association proposes to show that the express companies sometimes value the terminal service as low as four cents for individual shipments, and sometimes as high as several dollars for precisely the same work. It is desirable that the express companies should show to the Legislatures of the several States what the conditions are that warrant an elastic scale of charges, varying several thousand per cent., for precisely similar service."

In a letter recently received from Mr. W. F. Dixon, chief engineer of the Sormovo Locomotive Works, Nijni-Novgorod, Russia, he writes: "To-day our twenty-eighth locomotive, which happens to be the last of the first government order we received, is on its trial trip of 100 miles up the Nijni line towards Moscow and back. As I wrote you a few weeks ago, we got out seven engines in October, and this month we shall get up to nine."

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Editorial Change.

On the first of the year, Mr. O. H. Reynolds, who has been on our editorial staff for over three years, severs his connection with LOCOMOTIVE ENGINEERING to return to railroad service. Mr. Reynolds leaves us with mutual esteem. He has been a faithful, industrious worker, and can be depended upon to do his whole duty in any position he undertakes to fill.

Mr. Clinton B. Conger, who is so well known to trainmen on account of his writings relating to locomotive and train mechanism, has joined our editorial staff. He has been lately road foreman of engines on the Chicago & West Michigan Railroad, and was for some years consulting engineer for the Governor of Michigan. Mr. Conger has a large railroad acquaintance, having been for several years president of the Traveling Engineers' Association, and we commend him to the numerous railroad men who are strangers that his new duties will bring him in contact with.

Burned Out.

Our office at 256 Broadway was on the fifteenth story of a high building which we watched carefully while under construction, and had reason to believe was entirely fireproof. This faith remained unshaken until the morning of December 5th, when we learned that the offices on the upper part of the building had been stripped of all combustible matter by a fire that broke out in the adjoining building. A fierce hurricane was blowing at the time, and the wind forced the flames through the windows of the upper offices, and they acted upon the wood work like the flame of a reverberatory furnace. All the wood work was consumed, but the brick arches which supported the floors stood unscathed, and our safe rested on one of these. The contents came out badly scorched, but all the books are legible and we will be able to identify payments received from subscribers and from advertisers.

We lost all our office furniture and a large stock of books that we kept for sale, besides our reference library, but the most serious loss was our mailing list. That was so large that the safe would not hold it and so it was burned up. Our books do not give the address of those who have paid subscriptions, so we will be dependent to a great extent upon their good offices in helping us to renew our list. We ask our friends if they hear of any subscriber having failed to receive the January paper to see that we are notified.

The fire burned up a mass of manuscripts which were waiting to be sent to the printing office. Among them were letters, articles and questions, and we do not know who the writers were, except in a few cases. The loss has this month crippled our correspondence department, but it is the only department that has suffered.

The entire list of our subscription agents, and there were nearly a thousand of them, was burned out. We have identified many of them from the money transactions found in our books, but we have failed to find the names of many of the new men, and now make the request that they write to us.

While the fire has caused us great loss and inconvenience we do not propose to let it hurt the paper. On the contrary, we are rather moved to stimulated efforts to show our friends the Phenix-like character of LOCOMOTIVE ENGINEERING in rising from its ashes into more vigorous life.

We take this occasion to express our appreciation of the numerous letters of sympathy which have reached us. It often requires a touch of misfortune to enable an individual or a company to understand the volume of their friends. We have reason to be highly gratified in this respect.

Features for 1899.

We had several new features planned for 1899, and also had a nice little story about them all written up for this issue, but as the best laid plans don't always pan out, so this little story of the "going to be's" went up in smoke. But the plans were fireproof if the building was not, and though they may be delayed they have not been abandoned—don't do business that way.

One of the main features is the Compound Charts, which are safe, and the first of which accompanies this issue. We had an article compiled from the experience of engineers who have run Schenectady compounds, all ready to accompany this, but the article wasn't fireproof, and we can only give part of that now—more later, we hope. There is a brief but correct description of the engine in this issue, however, which will make the workings clear, and, taken with the charts will be of value to any railroad man.

Another feature which will be appreciated by the mechanical engineers, as well as others who like to keep tab on the new engines and know where they differ in main dimensions. This is the liberal use of "engine diagrams" showing the leading features of the engines at a glance and in a handy form for reference at any time. These will be of a uniform size and can be filed in any card file or in a note book. While it will not be necessary to show every engine by diagram there will be enough of them to make quite a collection during the year.

Last but not least comes the monthly index, which will be found on the page with the advertisers' index, usually the one following the last reading page. We feel that these will be additions to the paper and that they will be so considered by our readers.

How to Calculate the Power of Locomotives.

The practice of tonnage rating which has been steadily growing into favor for the last few years has set many officials outside of the mechanical departments to figuring upon the power of locomotives and on the trains all kinds of engines ought to haul over certain divisions. We have received direct evidence of this in a growing demand for our graphic computers of locomotive traction, and from letters received asking about train resistance on grades and curves. As our computers were all destroyed in the fire, we have determined to write particulars of how any man knowing the first four rules of arithmetic can figure out for himself the tonnage that any locomotive can haul on any grade or curve. The information to be given is found in engineering books, but many railroad men do not know where to look for the technical data they need.

The power capacity of steam engines is generally expressed in horse-power, which is a measurable quantity and is based on the arbitrary measure of one horse-power being equal to the effort of raising 33,000 pounds one foot per minute. That is the unit used for measuring the power transmitted by nearly all kinds of prime motor and machines. It is sometimes applied to locomotives, but for a variety of reasons the horse-power capacity of a locomotive does not convey to the ordinary railroad mind its capacity for hauling different kinds of trains. The utility of a locomotive for train pulling has to be expressed in a different way.

When practical railroad men know the size of cylinders, the diameter of driving wheels, the weight resting upon them, and the boiler dimensions, they understand what kind of service the engine is adapted for, and in a general way what weight of train it will haul. A general idea of power is, however, a guess which may be considerably away from the truth. Guessing is not a good basis for designing or estimating the power of a locomotive, and so methods have been devised for figuring out the power and speed that certain dimensions will develop, which are as correct and reliable as any other engineering rules. It has become customary to reckon the power of a locomotive by the tractive force the driving wheels will exert upon the rail. That is the resisting weight which the engine will start from a state of rest.

The tractive force is the power which the pistons of a locomotive are capable of exerting through the driving wheels to move engine and train. The efficiency of the engine's tractive power is dependent upon the adhesion of the wheels to the rails. When adhesion is insufficient, the power transmitted through the pistons and rods will slip the wheels, and no useful effect will result. To prevent the slipping of locomotive driving wheels, it is necessary to put resting upon them at least four times in weight the force available for turning the driving wheels. If the weight is five or six times the piston power, the engine will do its work with less annoyance from slipping than would be the case with less weight. To prevent slipping on unwashed greasy rails more than double the adhesion would be necessary for that required on dry, clean rails. This cannot often be done, but the sand box provides the means for obtaining adhesion when the rails are in bad order.

Let us calculate the tractive power of the kind of engine most commonly used for hauling heavy passenger and fast freight trains, which has cylinders 19 x 26 inches, driving wheels 69 inches diameter, with a working pressure of 200 pounds to the square inch. The method by which the traction of a locomotive is calculated is, to square the diameter of the cylinders in inches, multiply that by the length of the stroke in inches, and divide by the diameter of the driving wheels in inches. The product of that sum will be the power exerted by the engine for every pound of pressure that reaches the cylinders from the boiler. A rule established by the Railway Master Mechanics' Association makes out that 85 per cent. of the boiler pressure is a fair average of what pressure will be useful in the cylinders at slow speed.

Follow that rule and the formula that we have described the method for finding out the tractive power of this particular locomotive would be:

$$T = \frac{d^2 L p}{D}$$

which means

d = diameter in inches squared.

L = the length of stroke in inches.

p = the mean effective pressure on piston.

D = the diameter of the driving wheels in inches.

T = the equivalent tractive force at the rails in pounds.

To apply this rule in practice, we find that d^2 means multiply 19 by itself, or square, so we have $19 \times 19 = 361 \times 26$, the stroke in inches, $= 9{,}386 \times 170$, mean effective pressure, $= 1{,}595{,}620 \div 69$, the diameter in inches of driving wheels, $= 23{,}125$. This gives 23,125 pounds as the power exerted at the circumference of the wheels, from which a deduction of about 10 per cent. is usually made for internal friction. We have assumed the boiler pressure to be 200 pounds and have used 85 per cent. of it.

The formula described for finding the power of a locomotive seems at first sight theoretical, and not based on a good philosophical foundation; but it is merely a short way, and agrees in results with more detailed methods of calculation. It agrees with another plan which is more in favor with civil engineers. That is, to ascertain the foot-pounds of work the engine is doing during each revolution of the driving wheels. By dividing the total thus found by the circumference of the drivers in feet, the force exerted through each foot which the engine moves is found.

Taking the same engine that we have figured on, with pistons 19 inches diameter, the area of one piston is 283.5294 square inches. This is multiplied by the mean average pressure of the steam, giving $283.5294 \times 170 = 48{,}199.9980$, which gives the aggregate pressure exerted by the steam on one piston. Multiplying that by 2 to take in both pistons, we have $96{,}399.9960 \times 4\frac{1}{3}$ feet, the stroke moved in a full revolution of the driving wheels, $= 417{,}733.3160 \div 18.0642$, the circumference of the driving wheels in feet, $=$ 23,125 pounds tractive force, the same as by the other rule.

There are several other methods of calculating locomotive tractive power, but they need not be described, as they bring precisely the same figures as those found.

When people wish to find the horsepower developed by a locomotive at various speeds, the steam engine indicator is usually employed to show the mean effective pressure inside of the cylinders. To explain the process to be followed, we will draw on our own experience with a representative locomotive pulling a fast passenger train.

The writer took indicator diagrams to find out the amount of work done by the locomotive in taking the Empire State Express over the New York Central Railroad. The details were published in LOCOMOTIVE ENGINEERING, June, 1892. A very common speed was 60 miles an hour. The engine had cylinders 19 x 24 inches, and driving wheels 78 inches diameter. The indicator diagram proved that the average cylinder pressure at 60 miles an hour was 53.7 pounds per square inch. The horse-power is calculated in the following manner:

283.5294 square inches piston area.
53.7 pounds M. E. pressure.

15,225.5 pressure on one piston.
2 pistons.

30,451 pressure transmitted from both cylinders.
4 feet piston travel in each revolution.

121,804
260 revolutions per minute.

$31{,}669{,}040 \div 33{,}000 = 959$ horse-power.

That method of calculation of course applies to all locomotives, and can be used when the area of piston revolutions per minute and mean effective cylinder pressure are known.

In the case recorded, the mean effective cylinder pressure was little more than 33.5 per cent. of the boiler pressure. When the same engine was running at 37.1 miles an hour, making 160 revolutions per minute, the M. E. P. was 59.2 pounds, and 37 was the percentage of boiler pressure. At 20 revolutions per minute the mean effective pressure would be little short of the 85 per cent. of boiler pressure of the Master Mechanics' rule, but it would gradually decrease as the piston speed increased.

The work that a locomotive has to do in pulling a train is described under the heading of Train Resistances.

To Calculate the Power of Compound Locomotives.

To calculate the tractive power of compound locomotives, it is necessary first to know what the mean effective pressure on the pistons is in every case, and any attempt at a theoretical exposition of the methods for arriving at this information by calculation is very unsatisfactory and inaccurate, for this reason: In the case of the two-cylinder compound, there are too many unknown quantities, among which are the volume of receiver, pressure of live steam through reducing valve, and the amount of back pressure. In the case of the four-cylinder compound, there is no receiver, but the element of back pressure is present on the high-pressure piston. For these reasons calculated pressures are not reliable for finding the power of this type of engine. The indicator furnishes the means to arrive at the correct mean effective pressure, and the formula for a two-cylinder compound when the mean effective pressure is known is:

$$\frac{d^2 \times M.E.P. \times s}{2 \times D}$$

in which d^2 = diameter of low pressure squared, $M.\ E.\ P.$ = mean effective pressure, s = stroke in inches, and D = diameter of driving wheel. In the absence of indicator cards showing cylinder pressures for a given boiler pressure, approxi-

mate results may be had by taking the mean effective pressure in the high-pressure cylinder at 70 per cent. of boiler pressure, which for 200 pounds boiler pressure would be 140 pounds. If the reducing valve gives steam to the low-pressure cylinder so as to equalize the work on both the pistons, the low-pressure cylinder will have a mean effective pressure of about 60 pounds for a ratio of cylinder of 2.3, which is the ratio between 23 and 35-inch cylinders. Referring the mean effective pressure to terms of the low-pressure cylinder, we have:

$$60 + \frac{140}{2.3} = 60 + 61 = 121 \text{ pounds.}$$

Placing the values in the formula, the tractive power equals:

$$\frac{35^2 \times 121 \times 32}{2 \times 55} = 43{,}120 \text{ pounds.}$$

If a deduction of 7 per cent. for internal friction is made, the net tractive power is about 40,000 pounds. The tractive power of the four-cylinder compound is also found by taking mean effective pressures known to have been found in service. These may be taken at 44 and 46 per cent. of the boiler pressure for the high and low-pressure cylinders, respectively, which for 200 pounds gage pressure equals 88 and 92 pounds mean effective pressure. Taking, for an example, an engine with high-pressure cylinders 18 inches diameter, low-pressure cylinders 30 inches diameter, stroke 30 inches, and diameter of drivers 55 inches, the ratio of cylinder areas is 2.77; and again referring the pressures to the low-pressure cylinder, we have

$$92 + \frac{88}{2.77} = 123 \text{ pounds mean effective}$$

pressure in the low-pressure cylinders. Placing these values in the formula, which in this case is somewhat different from the other, owing to the fact that there are now two cylinders to consider instead of one, we have:

$$\frac{30^2 \times 123 \times 30}{55} = 60{,}300 \text{ pounds.}$$

Taking out 7 per cent. for friction, as before, the tractive power is about 56,000 pounds.

Resistance of Trains.

The work which a locomotive performs in pulling a train is expended in overcoming the resistance due to wheel friction, gradients, curves and atmospheric or wind pressure. Ever since railroad trains began to be operated, engineers have been striving to devise formulæ for showing the train resistance at various speeds. From what we have found out in investigating this subject, we do not believe that it is possible to devise a formula that will show an approximation of the resistance due to different kinds of trains at different speeds when train tons are the basis of calculation.

The character and the load of the cars have a decided influence upon the resistance per ton of the train. Thus records made on the Chicago, Burlington & Quincy by the aid of the dynamometer car and indicator diagrams taken from the locomotive showed that with a train of loaded freight cars weighing 940 tons, running at a speed of 20 miles an hour, the average resistance on a straight, level track was 5½ pounds to the ton. A train of empty freight cars weighing 340 tons run at the same speed showed an average resistance of about 12 pounds to the ton.

There is good reason for believing that the heavier the cars in a train are loaded, the smaller the ton resistance is, just as was cited in the case of the loaded and empty cars. A particularly heavy train of freight cars, weighing, with engine and tender, 3,428 tons, pulled over the New York Central, to test the power of a new type of locomotive, indicated that the resistance at 20 miles an hour was about 4 pounds per ton.

We have collected a great mass of information concerning the resistance of trains, and careful study of the facts convinces us that to show an approximation of the resistance of different kinds of trains, it is necessary to treat every one separately. The late A. M. Wellington, of the *Engineering News*, devoted a great deal of study to the subject of train resistances, and in his day was probably the best living authority thereon. In 1892 Angus Sinclair took steam engine indicator diagrams from an engine pulling the Empire State Express, and in publishing them made some deductions about the resistance of the train. Mr. Wellington took the figures presented and compared them with records made by William Stroudley with express trains on the London, Chatham & South Coast Railway. From that and other data, he worked up a diagram of train resistances particulars of which will be given.

While investigating the power of locomotives required to pull certain heavy fast express trains, Mr. S. A. Vauclain, of the Baldwin Locomotive Works, carried on a series of independent experiments, and he found the train resistances a little less than those formulated by Wellington; but he expressed the belief that Wellington's figures were near enough for all practical purposes.

From the facts which we have obtained from dynamometer car records and other sources, that may be relied on to be nearly correct, we have worked out the two lines added to the Wellington and Vauclain formulæ given in the subjoined table:

RESISTANCE PER TON OF 2,000 POUNDS.

Miles per hour.	10	20	30	40	50	60	70
Resistance in pounds per ton of heavy pass'ger train (Wellington).	4.5	6	9.5	12	14	17	19
Vauclain	....	....	....	......	11	13	15
Loaded fr'ght cars	4	5.8	9.2	11.3	12.5	....	....
Empty " "	6	7.5	11	14	17	....	....

These figures apply to trains running on a straight level track on a calm day. With a fresh side wind a train of loaded cars of the same character as those which give a resistance of about 11 pounds per ton at 40 miles per hour, had the resistance increased to about 18 pounds per ton. The proportion of increase of resistance would be much greater with a train of empty cars.

The factors of train resistance due to grades are exact. If the steepness of the grade in feet is multiplied by 0.38 the quotient will be the resistance in pounds per ton. Suppose the grade is 1 per cent. or 52.8 feet to the mile, we have the problem $52.8 \times 0.38 = 20$, the number of pounds per ton for that grade. If the train with engine and tender weighs 1,000 tons, 20,000 pounds of tractive power will be required to overcome the resistance due to gravity.

Curves increase the train resistance of trains to an extent that depends very much upon the physical condition of the curve and upon the length of train that is upon it in getting round it. The allowance generally made for the resistance of curves is ½ pound per ton for each degree of curvature.

Inefficient Data for Indicator Diagrams.

Some people calling themselves mechanical engineers, who carry out tests of locomotives and report on the same, need to learn the alphabet of the business they pretend to be experts in. In making tests of locomotives where indicator diagrams are employed to show the steam distribution, it is very important that the piston speed should be given, yet within the last three months we have received voluminous details about locomotive tests in which no data were given by which we could calculate the piston speed. In one case an array of indicator diagrams was sent out, and fifty items about the engine and the conditions relating to the tests were given, yet not one of them gave dimensions of driving wheels or revolutions per minute, and we have not yet found out what the indicator diagrams amount to. The miles per hour were given, but that means nothing unless the size of driving wheels is reported.

In several other cases the miles per hour were recorded without the number of revolutions per minute; but by a stretch of courtesy the size of the driving wheels was given, and that enabled us to figure out the piston speed.

We are at a loss to know what people sending out particulars of that kind which are lacking in essential details expect to gain from the labor and expense they have incurred. It may seem something impressive for an ignorant man to receive a report made up principally of minimums, maximums and averages, but an engineer of any gumption knows that figures on these bases are worthless.

We would like to intimate to the engineers of tests who have not got out of the swaddling clothes of their business,

that the mean effective pressure in a locomotive cylinder will be influenced much more by the piston speed than by the velocity with which the engine is moving through space. There are not a few locomotives still in use with drivers 44 inches diameter, while 84 inches is by no means uncommon with fast passenger engines. An engine with driving wheels 44 inches diameter will make about 460 revolutions in running a mile, and if the train speed is 30 miles per hour, the piston speed will be 920 feet per minute, or a little over 15 feet per second. That does not give much time for the steam to get into the cylinders, and is liable to produce an indicator diagram suffering from what Hemenway called initial expansion.

An engine with driving wheels 84 inches diameter, on the other hand, while running at a train speed of 30 miles an hour, makes 120 revolutions per minute, and the speed of the piston is 480 feet per minute, or 8 feet per second. It does not require much imagination or calculation to find out that the engine with the large driving wheels permits the steam to be much more effective than it is in the engine with the smaller wheels.

These considerations ought to convince the people who make tests of locomotives that it is highly important to intimate the piston speed or revolutions at the time when certain indicator diagrams were taken. When an engine of any kind is undergoing tests, you want exact reports of what has been done. Averages of throttle opening, cut-off and other important data are worse than useless. If an engineer of tests is truly desirous of making an engineer-like record of what he has found out about a locomotive, we recommend him to apply to Mr. F. W. Dean, Exchange Building, Boston, for a form on which to record his findings.

The Weakest Parts of Locomotives.

There is a sort of evolution going on concerning the material for locomotive driving boxes and other parts subject to great strains. In the good old days when engines were light and were looked after by one engineer, who took care that there should be no destructive pound preparing the way for breakage, a good cast-iron driving box was entirely satisfactory. With fairly good fitting, it held the brass in position and led to no annoyance from pounds due to brasses being loose in the box. A cast-iron driving box never caused undue friction or cutting between itself and the driving wheel hub, and it moved up and down in the pedestals without raising irritating questions between the shop officials and the engineer.

That was the condition of affairs when a locomotive with cylinders 17 x 24 inches was considered powerful enough for ordinary train service. All at once people began to discover that engines of these dimensions were too weak to do the work of train hauling economically, and they began to demand larger cylinders and larger boilers. That was a legitimate line of progress; but it came to be the practice to put larger cylinders upon the old size of frames, and to put enlarged driving-box axles into the same size of jaws that had held the smaller axles. Then an epidemic of broken frames and broken axle boxes spread consternation on many railroads and imported grief and worriment into many a motive-power office.

In considering the cause of the breakages, those interested seldom went to the root or origin of the trouble. They would talk about cast iron not being so strong as it used to be, and decided to use brass or steel or some stronger material. Using a strong material that will reduce the weight of a locomotive is a move in the right direction, but it has been followed too often not from an appreciation of the sound engineering involved, but from a desire to get away from a weak member that was giving no end of annoyance.

No material has ever given such satisfactory service in driving axle boxes as good cast iron. With the old-time 17 x 24 inch engines, there was no trouble from the breakage of cast-iron axle boxes. When the dimensions of cylinders rose towards 20 x 24 inches or over, then the grief began, or rather consummated.

We would like to ask engineers familiar with the strength of material, if an axle box could not be designed for a 22 x 26 inch locomotive that would resist the strains that lead to breakage, just as well as the box that never broke under a 17 x 24 inch engine?

There is a saying that our motive-power officials are exceedingly conservative, and that it is a good characteristic. No doubt that is true, but the best kind of a characteristic can be carried too far. We have heard a good deal about broken axles and crank pins since the increase of locomotive powers has become the fashion. On looking into this subject, we find that the strength has not nearly kept pace with the destructive forces transmitted to axles and crank pins. A commonly accepted factor of safety in strains transmitted to the important members of a machine is 5. That is, it ought to take at least 5 times the ordinary working strains to break any part of a locomotive or any other kind of engine. We have found in modern practice, however, that many crank pins and axles do not have a factor of safety of 2. If a government inspector was to examine a steam boiler and find the factor of safety less than 3, he would require the steam to be reduced to a safe limit, and if officials of that kind were employed to investigate the destructive forces acting on locomotive axles and crank pins, a general reduction of power would be ordered.

Those who talk about axle boxes, axles, crank pins and other parts of a locomotive not being so efficient as they used to be, ought to find out the dimensions of the old-time locomotives and calculate on the resistance in good metal offered to prevent breakage. If they will do so faithfully, they will find that the old-time engineer paid more attention to details than the men of our generation, and that the ancient locomotive had its parts better designed for the work to be done than most of those now turned out to astonish the world by their wonderful performance.

Indexes.

Our friends will pardon a little delay with the index for 1898. It was practically completed and would have gone to the printer the next day, but was entirely destroyed. It will have to be made all over again, which is a long, tedious job, and there are so many things which must be done that it may be delayed a month or two. Applications will be filed and sent as soon as possible. If you want one, don't be bashful.

Tell Your Friends.

If any of your friends who are subscribers tell you they haven't received their paper, ask them to send us their name and address and tell us when they subscribed. We only saved a portion of the mailing list, but we want every man to get his paper, and will appreciate any assistance in this respect. Club-raisers will please send duplicate lists.

Graphic History of the Locomotive.

The charts we issued in 1896, showing the graphic history of the locomotive, were intended to be issued in book form, and we were collecting data for this at the time of the fire.

These are now destroyed and the book must be abandoned, much to our regret. Those who have inquired about it will please note that this book is among the missing.

"Long Island" is the name of a beautifully illustrated pamphlet published by the traffic department of the Long Island Railroad. It is lavishly illustrated by half-tone engravings showing a great number of pretty views of many picturesque scenes. We believe it is given free to persons interested in Long Island. The address of the department is Long Island City, N. Y.

Book Notices.

We expected to give notices of quite a number of books in our New Year number and had accumulated a drawer full of them that we were reading at odd times, but drawer and books all perished together. This will serve as an explanation of why books received will not be reviewed. If any of the publishers who are disappointed at receiving no notice of their books will try again we will gladly do our duty.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(1) W. P. T., Brooklyn, N. Y., asks:

Which expands most under heat, cast iron or wrought iron? A.—Wrought iron.

(2) R. P., Brooklyn, N. Y., asks:

What mixture of metal will give a good deal of strength with the smallest possible distortion from expansion and contraction? A.—Bismuth and lead. We do not know the best proportions.

(3) Inquirer, Wilmington, N. C., writes:

If a brass coil spring is spoiled by being heated how can you restore its springiness? A.—Throw it away and make a new one from hardened brass wire.

(4) Machinist, Cincinnati, Ohio:

Will you please give the number of cubic inches in 25 feet of ½-inch pipe, and also the table? A.—The area of a pipe nominally ½ inch inside diameter is 0.304 of a square inch by table in Kent's pocket-book. Twenty-five feet of such pipe would then have $0.304 \times 25 \times 12 = 91.2$ cubic inches.

(5) J. E. W., Kalamazoo, Mich., asks:

What are the chemical elements of coke, and what is its average weight per cubic foot? A.—The results of many analyses show an average of 92 per cent. of carbon, 1.25 per cent. of sulphur and 5 per cent. of ash. A solid cubic foot weighs from 40 to 50 pounds; a heaped cubic foot, broken, weighs about 30 pounds.

(6) I. N. O., Richmond, Va., writes:

I note considerable difference on locomotives, in the distance from top of rail to bottom of pilot. Please say what governs this distance. A.—Clearance of obstructions between the rails determines the hight at which a pilot should be above the track; like, for example, crossing planks which are sometimes placed somewhat higher than the rail top. It is general practice to make the space between rail and pilot not less than 3 inches.

(7) R. Y. S., Cleveland, writes:

What is the best way to find out when an engine is on the dead center, when you have to set the eccentrics on the road? A.—Move the engine till the crosshead is near the end of its travel on the guides. When the crosshead ceases to move, it is near the center; but it is well to keep pinching a little after it has stopped, to make up for lost motion. By moving it to the end of the guides, the eccentrics can be set near enough to provide for the engine being run to headquarters.

(8) Traveling Engineer, Chicago, writes:

Our people have been taking indicator diagrams from locomotives, and they seem to think that part of my duty is to tell all about the working of the engines from an examination of the cards. To tell the truth they are Greek to me. What would you advise me to do? A.—Get Hemenway on the Steam Engine Indicator from this office and study it. It is very simple and teaches many things about steam that every traveling engineer ought to know.

(9) R. N. L. P., St. Louis, Mo., writes:

I have been working for years on a plan to improve the valve motion of reversible engines, and I have worked out a plan which will require only one eccentric and will keep the lead opening uniform at all points of cut-off. Do you think it would pay to patent this invention? A.—No. That kind of an invention has been so often worked out and patented that we think it doubtful if you could obtain a patent. If you did, it would not be worth anything, for nobody in this country wants that kind of valve gear.

(10) C. R. B., Houston, Tex., writes:

Who is the author of the system known as the Brown system of managing railroad employes, and where can I find details of it? A.—The system was devised by Mr. G. R. Brown, general superintendent of the Fall Brook Railway, and has been in use on that railroad for a long time. Particulars of it were first made public by an article written by its author to LOCOMOTIVE ENGINEERING and published in February, 1894. More particulars were given in an article, also written by Mr. Brown, that appeared on page 22 of our volume of 1896.

(11) Shop Boy, Galesburg, Ill., says:

We have been discussing the proper area for balancing a slide valve, and we cannot agree and have resolved to refer the question to you. The valves of our engines are not nearly balanced evenly, which is the cause of the dispute. A.—The balanced area on valves in general use varies from 40 to 55 per cent. of the total area of rectangle of the valve faces. That is, a valve with face $10 \times 20 = 200$ square inches will have from 80 to 110 square inches balanced. We find generally that about 52 per cent. is about the best and as much as can be given sefely and prevent the valve from rising off its seat.

(12) R. P., Buffalo, writes:

I have tried many receipts for boiler head and stack polish but none of them are entirely satisfactory. Does LOCOMOTIVE ENGINEERING have anything to recommend? A.—Here is a recipe sent by Claude Ayers, of Clarendon, Texas: Asphaltum, 8 pounds, and fuse in an iron kettle. Then add 5 gallons of linseed oil, 1 pound litharge, ½ pound sulphate of zinc. Add these slowly or the mass will foam over. Boil three hours, then add 1½ pounds of dark gum amber and boil two hours more, or until the mass becomes quite thick when cool. After this it should be thinned to a proper consistency with turpentine.

(13) R. A. B., New Orleans, La., writes:

I am an apprentice machinist and I feel that my future success in the business will be badly handicapped because I have not had more than a common school education. I have been informed that you are in a position to get ambitious railroad mechanics the benefits of the Railway Master Mechanics' Scholarships. Would it cost much to go through that course? A.—The M. M. Scholarships are only for sons of members of the Railway Master Mechanics' Association. If you are genuinely anxious to learn the principles of mechanical engineering we advise you to take a course in the International Correspondence School, Scranton, Pa.

(14) R. A., St. Paul, Minn., writes:

We have been discussing the advantage of giving plenty of lead to an engine, to make it smart in full gear, but there is a difference of opinion among us about the effect of liberal lead. Our old engineers say that an engine cannot have too much lead under sensible restrictions, but others say that it should never be more than 1-16 inch in full gear. What would you advise? A.—The proper amount of lead depends on circumstances. If an engine has long eccentric blades, 1-16 inch lead would be all right. If the eccentric rods are very short, setting the valves without lead or even blind, would make a better working engine when running fast. More mistakes have been made by giving too much lead than by setting the valves with too little opening when the engine is at the beginning of the stroke.

(15) R. Y. B., Chicago, writes:

We have a sort of mutual humiliation club in connection with our association rooms, and it is the duty of members to expose the ignorance of others. We were discussing the peculiarities of calcium carbide the other evening and an offensive member who is fond of airing knowledge mostly pretended, said that there were several substances that would take fire and burn if thrown into water. Is there any foundation of truth in that assertion? A.—Yes. Several elementary substances have that peculiarity. Pure sodium, for instance, has such an affinity for oxygen that if a piece be thrown into a basin of water it will take the oxygen out of the water and use it as a means of maintaining combustion. It releases the hydrogen in the water and is sometimes employed to separate that element so that it can be collected for experimental purposes. Potassium acts in the same way.

If a question asked in this department is not answered it is because the party sending it did not give name and address.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Pretended Instruction Versus the True Thing.

A TALE OF TWO RAILROADS.

Good, practical air-brake instruction, the kind that brings good results, is one of the best paying investments a railroad company can make. Nearly all roads now make more or less pretense to instruct their men in air-brake practice; but too many apparent efforts are a mere pretense, and not the true thing. The contrasting results of the two methods of pretending to instruct and of really instructing are shown in the following true story.

Not a thousand miles from New York City is the L. M. & N. R. R., where good, practical air-brake instruction is given by an instructor whose services to his employers are worth triple the salary he receives. Last summer the L. M. & N. R. R. found itself competing sharply with a rival line for the sea-shore travel. This travel was profitable, even at the reduced rates offered, because of the large volume of the business; and the passenger agents were striving mightily to gain and hold control of the business.

One day, during the height of the sea-shore travel, the L. M. & N. R. R., through unusual promises of better service and quicker time, had secured a large excursion of four trains, nine coaches each. When nearly two-thirds of the distance to the sea-shore was covered, the air pump on the engine of the leading section stopped and refused to yield to the entreaties of the soft hammer to "get into the game."

Here was a predicament, indeed. No time to lose by resorting to the slow and uncertain expedient of braking nine coaches of excursionists in with hand brakes, and delaying the following sections. The only spare engine available was the switcher at R——, three miles beyond, and she would hinder more than help.

Engineer Tom Jennings took in the situation at a glance. He must locate the trouble and remedy it. He had enough pressure to make the water tank stop at R——, so closing the pump throttle and telling the fireman to look out for things, Jennings began to look for the trouble. The reversing piston was all right; so was the bush. The top head of the main valve had pulled off, stripping the thread on the stem. After stopping at the tank, the fireman dropped a little oil on the guides, links and eccentrics, and the brakeman took water while Jennings ran over to the switcher. Quickly explaining his trouble, he hastily unscrewed the cap of the switcher's pump, and was overjoyed on opening the pump throttle to see the main valve, reversing piston and bush shoot up in a geyser-like spray of steam and water and fall on the running board. Snatching up the part he wanted, he ran across, leaped upon his own engine, where, deaf to the questions and idiotic jabberings of the excited and half-frantic passenger agent and conductor, standing in the engine gangway, Jennings inserted the parts, screwed down the cap, and called in the flag. Upon the opening of the throttle the pump started off, promptly and energetically. Jennings thought that the pounding of the heads at the end of each stroke was, at that moment, the sweetest music he had ever heard.

The first section left R—— five minutes late; but all four of the sections, with their loads of nearly 2,500 delighted excursionists arrived in high spirits on time at the sea shore. Jennings' knowledge and skill which had pulled the L. M. & N. R. R. out of a tight place that day, was mentioned about the roundhouse for a few days, but was soon forgotten. Would that there were some way of measuring the number of dollars which Jennings saved to his company on that trip.

Almost simultaneous with the preceding incident, the X. Y. & Z. Ry., which is also less than a thousand miles from New York City, and merely pretends to give air-brake instruction, was having an air-brake experience of less favorable and more measurable character. A special train of sixteen carloads of fast race horses was *en route* from P—— to C——, a distance of 290 miles. The X. Y. & Z. Ry. had contracted to put the horses in C—— in ten hours or forfeit the freight, which was said to be $1,600. The entire train was air braked, had been put in splendid condition by the general air-brake inspector and three assistants, under the scathing fire of cuss words from the impetuous and self-esteemed train master, and was given a clear track over all trains; even two local passenger trains being side tracked for the horse train.

The first 105 miles were covered in three hours and fifteen minutes without accident or incident. Here the engine and the crews were changed. When eighteen miles out the engineer, after much loss of time from "sticking" brakes, swapped engines with a freight train on a siding, claiming that his pump would not pump more than 25 or 30 pounds of air, and was burning up at that. Then he had a new trouble with his second engine; he could not apply brakes for some reason or other, which he did not know and was too unskilled to discover. The train lost time, the engineer his reputation, and the dispatcher his religion. Finally the air was cut off by the crew, and the train handled with hand brakes. Five hours and twenty minutes were consumed in getting over the second division of 100 miles.

The engine and crews were again changed, and the remaining 85 miles were covered in quicker time than the "limited" usually did it; but the time lost by the engineer on the second division proved fatal to the contract, and the $1,600 was forfeited by the X. Y. & Z. Ry. to the race horse shippers.

Now comes the simple cause of the delay on the second division. Upon arriving at the terminal, the engine which was swapped off because it could pump but 25 or 30 pounds of air, was coupled to sixteen passenger coaches and tested. True enough the pressure could be pumped up to 30 pounds, but there it stopped and refused to go further. In casting about for the cause, the repairman found the nut which connects the delivery pipe of the pump to the main reservoir, loose, almost dropping off, and hanging by only two threads. With a few turns of the monkey-wrench he caused the trouble to disappear, and the pressure ran up quickly to 90 pounds, where the governor shut off the pump.

Thus the repairman cured the ailment, which, had the engineer properly handled it a few hours before, would have saved the railroad company $1,600. Think of it! In less than ten seconds time this engineer, had he possessed the skill and knowledge of a Jennings, could have rated his money earning power for a short time at more than $150 per second; more than that of the president, general manager or any other man in the company's employ. But when called upon this engineer was found helpless. So much for pretended air-brake instruction and the real thing.

An Error.

Mr. W. Ward, of the Gulf, Colorado & Santa Fé Railway, has called our attention to an error in answer to question 125, on page 521, November number, which reads, "Train-line pressure is registered on the red hand as usual." It should read as follows: Train-line pressure is registered on the black hand as usual.

The next convention of the Air-Brake Association will be held in Detroit, April 11, 1899. Be sure to make application in time and through your immediate officials for transportation.

was simply carrying main drum pressure through a defective gasket which should divide main drum pressure from chamber *D*. This we remedied by tightening the nuts on the four bolts.

These are but a few of the things a person will come in contact with in the course of time; but it is necessary to know the causes and effects, and be able to apply a remedy. If we are wise, we will study this matter up, so as to be able to remedy these defects when they appear, and the time thus spent will never be regretted.

W. A. Reese,
P. & L. E. R. R.

Youngstown, Ohio.

Disposing of the Air Pump Exhaust.

Editors:

Replying to your request in November issue in regard to air-pump exhaust, will give our experience in that line.

About two years ago we began putting the pump exhaust into the exhaust ports under the saddle, and now have all our engines equipped in that way.

There is no perceptible back pressure on the pump; no noisy exhaust, and the saving on the wood pile (we burn wood exclusively) has, I think, more than repaid the expense of making the change.

The manner of putting in the exhaust was quite simple in our case, as the engines were equipped with cocks to drain the exhaust cavities. These drain cocks were ordinary cylinder cocks, operated by the cylinder cock rigging in the usual way. We put a tee above each drain cock, ran a three-quarter pipe to a point just outside the back of the saddle on each side, connected the two pipes by means of elbows and a union, put a 1-inch tee in center, and connected in pump exhaust with a curved pipe to conform with the boiler. We put a ½-inch drain cock in bottom of 1-inch tee to drain pipe and exhaust ports when cylinder cocks are closed and pump running.

W. W. Rickard,
F'man Mach. Dept., Sonora Ry.

Guaymas, Sonora, Mexico.

The Retaining Valve.

Editors:

A statement was made at the last M. C. B. convention, and Locomotive Engineering later made a reference to it, I believe, that the retaining valve, as generally found in service, would leak off in three minutes. This may be true, yet we know that the retaining valve can easily be placed and kept in condition that it will not materially reduce below 15 pounds in a minute and a half. It is doing this every day on roads where air brakes are given due attention; and if it is not giving this service elsewhere, the reason is that it is not properly looked after.

F. B. Farmer.

St. Paul, Minn.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(1) A. L. M., Buffalo, N. Y., asks:

Will water in the main reservoir keep brakes from setting? A.—Not unless it gets back in the train pipe and triples. It takes up main reservoir space and hinders releasing of brakes.

(2) J. C. H., Waldo, Fla., asks:

After making an emergency stop with quick-action triples, 70 pounds train-line pressure, what pressure is there in the auxiliaries? A.—As the brake cylinder and auxiliary reservoir on each car are then in direct communication, they both have about 60 pounds with ordinary piston travel.

(3) W. C. G., Chester, Pa., writes:

Some of our D-5 rotary valves have the warning port hole large in the under side of the rotary, while some have the port hole on the underneath side, just as large as a pin hole. Will you please state why this difference, and which is preferable? A.—We understand that some of the first D-5 valves had the warning port in rotary valve large on the under side and small on the upper side. The later ones, however, have the large opening of the port on top and the smaller opening on the bottom.

(4) F. F., Fairbury, Neb., asks:

Is it possible to obtain an emergency application with a double-header, brakes applied from leading engine; second engine only equipped with air brakes? A.—It is assumed that the leading engine is piped only, or has the brakes cut out. The ability to get quick action through two engines depends upon the piping. If it is reasonably free from bends and elbows, the quick action on cars behind the engines will be had; otherwise it will not. See article elsewhere in this department on this subject.

(5) J. M. McC., Cleveland, O., writes:

In your answer to question 137, December number, you say that the repairman can tell when the graduating spring in the plain triple is stiff enough by pressing his thumb against it. Ought there not to be a test this spring should be put through? A.—As we said in answer to question 137, an accurate test of the plain triple graduating spring is not of very great importance, but if a regular prescribed test is desired, a device of the kind used by Wm. Malthaner, of the D. & H. C. Ry. at Green Island, N. Y., for quick-action triple might be employed. The device is illustrated elsewhere in this department.

(6) F. F., Fairbury, Neb., asks:

How long will brakes remain set when a reduction of 20 pounds is made from 70 pounds train line pressure with triple valve in ordinary condition, and immediately after application is made train line pipe is entirely emptied and broken? A.—It depends entirely upon the condition of the packing leather in the brake cylinder pistons and the non-return check valves in the triples. Supposing that these parts were in reasonably good condition, the brakes should stay set some considerable time, say, anywhere from several minutes to an hour or more; but if the parts are not in good condition, the brakes would leak off sooner or later, according to the magnitude of the poor condition.

(7) J. C. H., Waldo, Fla., writes:

On page 39, Blackall's Air-Brake Catechism, the question is asked: "After a partial service application, can we get the quick action?" Part of the answer is as follows: "After a light reduction a gain over the pressure obtained in full service can be made by going to emergency position if the piston travel is a fair length, but not with a short travel." I don't understand how more pressure can be obtained with a long travel than a short one. Please explain. A.—This depends upon the amount of pressure already in the brake cylinder. If there is no pressure, full quick action will be obtained. If a small service application has been made, less quick action will be had. If an almost full service has been made, no quick action can be gotten. If the travel is short, the cylinder pressure will be higher with a small reduction than though the travel were long. Thus the cylinder pressure obtained with a light reduction on a short travel will be correspondingly high, will more nearly approach the 50 pounds or full service application, and will so effectively oppose the entrance of train-pipe pressure that little, if any, quick action can be added.

(8) W. B. M., Columbia, Pa., writes:

I had a light engine with 1890 brake valve. My pressures were 100 pounds on main reservoir and 70 pounds train pipe. I took on twelve air-brake cars and charged them to 70 pounds in full release position, but when handle was moved to running position, main reservoir pressure would increase to 100 pounds, and train line would drop to 40 pounds. There were no leaks in the train. The excess pressure valve was gummed up, but cleaning made no difference. Was obliged to carry handle in full release. Brakes would apply promptly. What was the cause of the trouble? A.—The excess pressure spring was perhaps too stiff, or had too many washers in behind it, and gave too much excess pressure. This was shown when the train was coupled on. With the light engine, the slight leakage of main reservoir pressure past the rotary valve or excess pressure valve into the train pipe, increased that pressure to 70 pounds. Had the light engine stood alone with handle on running position long enough, the train pipe pressure would probably have risen above 70, and the main reservoir fallen below 100, equalizing somewhere between 80 and 90 pounds. Although no leaks in the train were detected, there were doubtless numerous small leaks there.

Postponing Discussion of Papers Read at Railroad Clubs.

Some of the railroad clubs have adopted the practice of reading papers at one meeting and discussing them at the next. We never thought the practice a good one. In theory it is all right because the members are supposed to take the paper home with them, consider calmly its contents and obtain information that will support or refute the facts and arguments advanced.

Railroad men as a rule are too busy to devote much of their time outside of the meetings to what has been introduced to railroad clubs, and the practical result of the practice of delaying the discussion of any paper is that most of the members have forgotten what was said, and the discussion amounts to nothing.

We notice that the Central Railroad Club has decided to change the practice of postponing for a month the discussion of papers introduced. All the other clubs which have introduced that practice could change with advantage to all concerned.

A much better plan than postponing the discussion of a paper for a month is to send out advance copies a week ahead of the meeting and let the members be prepared to discuss it when it is read.

Locomotive Jumped on a Car.

An esteemed correspondent writes us: "I send you to-day, under separate cover, a photo of wreck that happened recently on the C., H. & D. Ry., in the East Toledo yards, and which I shall be pleased to have you reproduce in LOCOMOTIVE ENGINEERING. The following is an account of it as seen by myself and others at the time it happened. Mail train No. 6, drawn by engine 117, C. S. Rockhill, engineer, ran into an open switch and collided with about ten or twelve cars which stood just in to clear. The head car, and in which the engine is shown in the picture, was an 'Empire Line,' loaded with wheat. Next was an empty box car, and then a car of coal (gondola). Now, here is where the curious part of it is. When the engine struck, she raised up, and, like a deer on the jump, plunged right into the car, her engine trucks going back under her and knocking the link motion off, and then lodging between the tank trucks, derailing the tank, and at the same time tearing the engine loose from the tank. At this point, the tank and the balance of the train came to a stop, while the engine riding in the car of wheat, and the cars she struck kept on going down the side track for a distance of about 300 feet. Now, there was not a wheel off the track, with the exception of the tank, and the leading pair of wheels of the head car in the train (and of course, the engine itself). The engine's back drivers broke through the car floor and rested square on top of the truck wheels of the car.

"Aside from the loss of the pilot, headlight, stack and bell, and the link motion spoken of before, the engine proper was not damaged at all, as far as I know. One might say, too, that the car in which the engine is shown was not a total wreck, that is, it did not look so at first sight. Of course, all the sills were cracked and splintered some, and the roof was gone, and one side, but the sides were there, and what is more there was a half car-load of wheat in it along with the engine."

Railroads in Cuba.

In an account of Cuba by W. J. Clark the following remarks are made about the railroad in Cuba and the rolling stock used thereon:

"The existing roads may all be presumed to be of standard gage, 4 feet 8½ inches, unless special mention is made

CURIOUS WRECK.

of any variation in our detailed description. The methods of construction followed are in accordance with both the American and English systems—in the former the rails being spiked directly to the ties, and in the latter the rails being laid in iron chairs held in position by means of wooden wedges. Some companies have followed both methods of construction. To a great extent the roads are well ballasted with stone, and some heavy steel rails, weighing from 60 to 80 pounds per yard, have been used; but, generally speaking, the tracks are of light weight, and consequently many of them are rough. No doubt, owing to neglect during the later year of the present insurrection, much of the trackage will be found to be in exceedingly bad condition, for, on account of the heavy tropical rains, unless tracks are well ballasted and drained, constant surfacing is required.

"The rolling stock of the various companies has consisted principally of the American type of locomotives and cars, neither being as large nor as heavy as those now used on the American roads, and it is presumed that, owing to the experience of the past three years, both they and the station buildings will be found to be badly run down. Yet as all the railway lines have been used extensively by the Spanish government for military purposes this situation may not be so bad as might naturally be expected, and undoubtedly, if the railway companies are able to collect their bills against the Spanish government for the transportation of troops they will all be in fairly good condition financially. It is natural to believe, however, that there will be some uncertainty regarding their ability to make these collections. Some of the more important lines are owned by English capitalists; hence it is fair to suppose that serious and perhaps successful efforts will be made to have the bills of these lines paid.

"Owing to the excessive tariff on all railroad material, especially rolling stock, it will be found that none of the lines have a surplus of the latter, and the universal tendency has been to use locomotives and cars until they actually fell to pieces. Some of the roads have well equipped shops, while others are deficient in this respect. The roads in the central and western part of the island use coal-burning locomotives; in the eastern portion, wood-burners."

A new mineral of black, lustrous color, locally called "manjak," has been found in the Antillean island, Barbadoes. It occurs at shallow depths, or even at the surface, in beds from 10 to 20 feet in thickness. It is supposed to be solidified petroleum, from the fact that petroleum in a fluid state is frequently found oozing from the ground or floating on water in the vicinity. The better qualities of the mineral contain 2 per cent. water, 70.85 per cent. volatile matter, 26.97 per cent. fixed organic matter, and 0.18 per cent. mineral matter; hence it has considerably more bitumen than the Trinidad asphalt, which contains 21.30 per cent. water and 38 per cent. ash. The material is used for the manufacture of varnish, cement and fuel, being mixed with peat for the latter purpose. Owing to its con-conducting properties, it might be used for electrical purposes instead of gutta percha.

The Nathan Manufacturing Company are assignees of an invention having an important bearing on the lubricating apparatus of a locomotive. The inventor is Mr. L. Kaczander, one of the officials of their plant, and embraces in combination with the lubricator with the usual outlet and pipes, an auxiliary pipe from the steam supply and a valve in same with connections from the valve to throttle lever, so that the valve and throttle are operative at the same itme.

The business of making metal polish seems to be prospering with George William Hoffman, Indianapolis, for he has just informed us he has lately put into his shops a thirty-five horse-power Otto gas engine. The additional power is needed to run the manufacturing plant.

Provide Cheap Light from the Sun.

During the depression in business which now appears to be behind us, railroad officers were badly harassed by what were often unreasonable demands for reduction of expenses. As usual the mechanical department had to stand the hardest pressure, and it was pitiful the means resorted to in many cases to make a dollar buy more than it formerly did. Some of the roads came out of the ordeal in a condition that will call for costly recuperation measures.

Not a little ingenuity was displayed in finding means to weather the retrenchment storm, but there was one good means of saving expenses that was sadly neglected in many shops and it is still waiting to be employed. If there is one thing more than another that makes the production of mechanical operations expensive, it is want of light. When hard times came it was the sensible thing for shop foremen and others upon whom fell the burden of reducing expenses, to clean up windows, whiten walls and do everything in their power to make the light of heaven shine freely into their shops and floors. But instead of doing that they took the opposite course. The road had become too poor, they said, to employ men cleaning windows and whitewash costs money; so instead of making the best of the light that comes free as air, they fell back upon oil lamps or even upon electric lights.

During a recent tour among railroad shops, we found at several places the cleaning up of windows and the whitewashing of walls going on. This was a testimony of respect for the improved times, and most of the men engaged in pushing the work seemed to think that they could sacrifice a little to appearances now that earnings are growing fairly good. One of the men who was pushing cleansing and whitening operations was puzzled when the writer remarked that he was working to reduce operating expenses. It took considerable explanation to make this official understand that increased daylight inside the shop would enable the workmen to finish the jobs they were doing more accurately and with more dispatch than was possible when they were groping in semi-darkness. The man who injects an extra ray of light into a workshop increases the output without increase of expense.

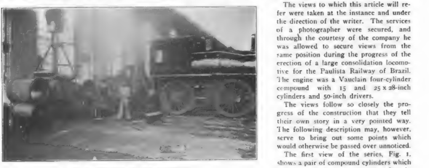


FIG. 1. BRINGING IN THE CYLINDERS.

The Radical Sign Did It.

A Cornell student, who had been celebrating the Thanksgiving football game stood on the station platform, gazing as steadily as his condition would permit at a plate on the side of the smokebox of Lehigh Valley locomotive No. 471, bearing the mystic symbols, $8 \, {}^{C}_{62} \, 19T$. "What the deuce is that stunt, anyway?" he muttered.

There was no railroad man at hand to explain that the group of symbols was a ready reference for shop use, and meant that the locomotive was of class C, had 8 wheels, 62-inch driving wheels, 19-inch cylinders and firebox on top of the frames.

"What the deuce does that nest of hieroglyphics mean?" he repeated. "Looks like some of Prof. Church's doin's on the blackboard last year. Oh! I see now," he exulted. "Some goat's left an incomplete statement. I'll fix it!"

With a piece of billiard-room chalk, fished from his top-coat pocket, he scratched on the engine side. "There!" he said, stepping back and viewing his work with a satisfied smile, "that's better. There's some sense to it now."

The group of symbols he had "fixed" stood thus: $\sqrt{8 \, {}^{C}_{62} \, 19T} = 0$

A curious kind of snow plow has been patented by Cyrille Daff, Millbury, Mass. It looks like a pilot plow with auger-like screws extending from the point to the flank of the plow, one on each side. There is too much mechanism about it.

Erecting a Locomotive.

BY PROFESSOR R. A. SMART, PURDUE UNIVERSITY.

The method employed in erecting locomotives is largely affected by the arrangement of and the facilities afforded by the erecting shop. The arrangement of the erecting tracks along or across the length of the shop, the number, kind and capacity of the cranes, and the means provided for bringing to the shop the various parts—cylinders, boilers, wheels, frames, etc.—all these things have their effect upon the problem of erection.

The readers of LOCOMOTIVE ENGINEERING are doubtless familiar with the problem of locomotive erection in a general way, or perhaps as it is accomplished at their own shops. They will, therefore, be interested to see in a graphic way the method employed at the Baldwin Locomotive Works, which, as many know, has the enormous capacity of 1,000 locomotives per annum, and whose facilities are, therefore, of the very best.

The views to which this article will refer were taken at the instance and under the direction of the writer. The services of a photographer were secured, and through the courtesy of the company he was allowed to secure views from the same position during the progress of the erection of a large consolidation locomotive for the Paulista Railway of Brazil. The engine was a Vauclain four-cylinder compound with 15 and 25 x 28-inch cylinders and 50-inch drivers.

The views follow so closely the progress of the construction that they tell their own story in a very pointed way. The following description may, however, serve to bring out some points which would otherwise be passed over unnoticed.

The first view of the series, Fig. 1, shows a pair of compound cylinders which have just arrived on the erecting floor in charge of the crane. They are shown suspended over the track upon which the locomotive is to be built. As the machine is to be built heading in the same direction as the eight-wheeler shown in the background, the crane brings the cylinders forward and deposits them upon jacks, over the center of the track, as shown in Fig. 2.

This view shows two pairs of cylinders for the same class of engines, set upon adjoining tracks, awaiting the arrival of the frames. The next view shows the frames in place on both pairs of cylinders. On the pair in the foreground the spiders in the right hand cylinders indicate that the frames have been lined up and, as will be observed, some of the cross bracing is already in place.

Now, while waiting for the boiler to arrive, many minor fittings are applied. The guide yokes and guides are placed in position, the bumper beam made fast and the cylinders jacketed. In Fig. 4 the boiler has just arrived from the boiler shop and is being lowered into position.

The boiler for the machine on the second track is already in place, and it will be noticed that steps are being taken to begin the erection of a third machine on the track at the left. The left frame for this engine is seen lying on the floor near the track. When the boiler had been carefully lowered into place and just after the crane had moved away to serve another part of the floor, the view shown in Fig. 5 was taken.

Now our locomotive is nearly ready for the wheels and in the meantime more of the smaller fittings are applied. Then the crane arrives on the scene and lifts the structure bodily into the air, where our photographer caught a view of it for Fig. 6. Then the wheels, which were already in waiting on the forward end of the track, are rolled under the suspended machine. This stage of the process is shown in Fig. 7, just as the crane is beginning to lower away.

In Fig. 8 we begin to have something which looks somewhat like a locomotive. Excepting the lack of the cab, stack and pilot, the outlines are those which are familiar to us. This view is particularly interesting as illustrating the rapidity and system with which the work is conducted at the Baldwin Works. Immediately after the boiler in the foreground had been lowered into place, and while the photographer was adjusting his camera to take the view, the crane moved away, brought up a boiler for the machine which was being erected on the next track, and was just lowering it into place while the exposure was being made. The shadowy outlines of the boiler on the way down may be plainly seen at the right of the picture.

Now the trimmings are put on. The pony truck is put under the front end. The boiler is lagged and jacketed. The rod and valve work is put up. The running board, cab and fixtures are applied. The stack and pilot are put in place. Then, after the addition of numerous smaller parts and the judicious application of paint and varnish, the photographer is enabled to show as the last picture of the series, Fig. 9. During the progress of the erection, the boiler has been thoroughly tested, and the moving parts have been tried under steam while the whole machine was supported upon rollers. It is, therefore, ready to enter the service for which it was intended.

In conclusion the writer would call attention to the fact that it is only by the close study and perfecting of the details of manufacture that the rapidity and precision of the final steps of the progress of locomotive building, which are evidenced by the illustrations, can be attained. The work of the erecting floor represents the culmination of all the work which has preceded; it is the final test of the quality of the output and the capacities of all the various departments; a weakness in any portion of the manufacturing organization is at once felt on the erecting floor, either from failure of the part to arrive on time, or from failure to fit into its proper place when it does arrive, in either case causing serious delay.

It should be a source of pride to railroad men that the manufacture of the locomotive has been so systematized and perfected as to rank among the most advanced examples of machine building.

Using the Bible as a Weapon.

Railroad general passenger agents are not reputed to be any holier than other classes of railroad men, but a curious thing about some of them is that when they begin quarreling they always use the Bible as a weapon to hit each other with. This epidemic has broken out again, and the combatants are Mr. Geo. H. Daniels, of the New York Central, and Mr. D. B. Martin, of the Baltimore & Ohio. Owing to what he conceived to be just cause, Mr. Martin wrote to Mr. Daniels:

"We learn with regret that at this most inopportune time, without conference or advice, you have arbitrarily reduced regularly established fares from common points in our territory to Pacific Coast points, and by request upon initial lines at the Pacific Coast, succeeded in obtaining similar reductions in authorized fares eastbound.

"We deprecate such arbitrary action as tending to demoralization and calculated to provoke retaliatory measures and unnecessarily reduce the revenues of all lines.

"We therefore respectfully enter this, our protest, against such unwarranted action on your part, suggesting that, in our opinion, when changes in authorized fares are contemplated, due notice should be given to all interested lines, in accordance with the established usage, and would request an immediate restoration of rates to those in effect November 1, 1898, and ask your prompt reply to be addressed to D. B. Martin, Baltimore, Md."

Mr. George H. Daniels, who was a model Sunday School boy a few years ago, and still dotes on a concordance, used the knowledge gained in his youth to say:

"D. B. Martin, Baltimore, Md.:

"I think it would be an opportune time for you to read the forty-first verse of the sixth chapter of the Gospel according to St. Luke."

Mr. Martin sent out to a notary public and borrowed a Bible, and after diligent search found the chapter and verse referred to, which reads: "And why beholdest thou the mote that is in thy brother's eye, but perceivest not the beam that is in thine own eye?"

About the time they had found the verse, Mr. Maddy, the press agent, who is a Sunday-school superintendent, happened into Mr. Martin's office, and being learned in Biblical lore, he suggested to Mr. Martin another verse that would be highly appropriate, as it applied to Mr. Daniels. When they had finished the answer sent was:

"Your telegram December 2d. We have been guided through life by the teachings of St. Luke, and fully concur that his sixth chapter is very appropriate to the case in point, and for your personal application would advise reading last half of verse immediately following.

"D. B. MARTIN."

The last half of the following verse reads as follows: "Thou hypocrite, cast out first the beam out of thine own eye, and then shalt thou see clearly to pull out the mote that is in thy brother's eye."

FIG. 2. CYLINDERS IN POSITION.

The well-known firm of Manning, Maxwell & Moore, of 111 Liberty street, New York, have engaged the three lower floors of a fine building going up on Liberty street, near Broadway, and they will move in on May 1. They are going to be next door neighbors to LOCOMOTIVE ENGINEERING.

The Care of Wedges.

The wedges on a locomotive, as all of us should know, are intended to take up the lost motion between the driving boxes and the jaws of the frame. A very little lost motion at this point causes a pound which shakes and jars the whole machine, and in time will loosen the brass in that box, as well as spoiling the parallel rods. A very good reason why a loose wedge or loose driving box brass pounds so much worse than the same amount of lost motion in the main rod is because there is so great a leverage exerted on it by the connections from the pistons.

If we consider the box on the other end of the axle as the fulcrum you will see that the defective box is about one-third of the distance from the crank pin, which gives it the power across to the other box. The care and proper adjustment of the wedges is a matter of the first importance if the engine is to ride smoothly and maintain the driving boxes and rods in good order. If a wedge gets loose and works be remedied at once if possible. This test will locate right off whether the pound is between the journal and the box or between the box and the wedge.

If the wedges are in good order, that is, with the proper taper and smooth bearing surfaces, they should be moved up by the wedge bolts till they are tight and take up all the lost motion. This will locate the exact point at which they are too tight so they are liable to stick; you can then draw it down just enough to allow the box a free movement up and down with the least possible amount of play forward and back; about one-sixteenth of an inch is enough to pull it down, after which the jam nuts should be made fast again.

Some wedges also have a bolt through the side of the jaw, which holds the wedge. This must be slacked off before wedge is moved, and made tight after the wedge is set.

If you wish to make a speedy and certain job of this work, get under the engine, slack off the jam nuts and get wedges loose and started up; have two men with pinch bars pinch against each other at the same wheel, which will lift the wheel up off the rail. As long as the box moves freely the wedge is not too tight; when it begins to stick the men will raise frame and all. If the wedge or shoe is worn more in the middle than at the bottom end the box is apt to stick before the wedge is tight at the top. The pinch bar method will locate this trouble at once, as well as showing a case of the wedge sticking on the jaw so it will not move. If this is a new way to you it is well worth trying at the first opportunity.

The wedges should be set up when the engine frame and boxes are warm, as expansion cuts quite a figure in this matter. When a box begins to get hot, slack down the wedge before it sticks, unless you can cool off the box at once. Sometimes the first notice you have of a hot driving box is a stuck wedge.

FIG. 3. SECURING FRAMES TO CYLINDERS.

down, set it up at the first opportunity. Do not wait till next trip any more than you would to fix a main rod with one of the keys loose and working out.

To locate a wedge which needs setting up, stand the engine with the crank pin on the top quarter on the side you are about to examine. This position will put the eccentric straps up out of your way on the main axle, and gives the best chance to see any movement of the driving box between the jaws of the frame. If there is a driver brake, cut it out and hold the engine with the tender brake or by blocking the wheels. If you set the driver brake it will hold the boxes solid, so that you will not notice any lost motion. Have the fireman reverse the engine several times with a moderate pressure of steam in the cylinders, and watch the box; if it moves back and forth between the jaws, as the steam pressure is changed from one side to the other of the piston, the trouble is located and should

If they stick very bad and catch on the box the wedge bolts are liable to break. This may let the wedge work up and jam solid against the taper side of the jaw. Look out for this. In case of a stuck wedge run the other wheel on that side over a block, which will lower the box on the stuck wedge so you can get it loose. If the wedge bolts break off, sometimes they can be spliced so as to hold as well as ever. This refers to wedge bolts which go through the pedestal binder and having nuts both above and below the binder. They usually break off at the top of the nut which is above the binder. Probably the nut does not fit square on the binder and strains the bolt to one side till it breaks off. Run the top nut up on the part of the bolt which goes into the wedge so that it is about half way through the nut; take out the lower part of the broken bolt and slip enough washers under the nut to fill in the space; then screw the bottom end of the bolt up into the nut through the washers. This makes a splice of the bolt in the middle of the nut, and the washers under the nut hold the wedge up. A bolt well spliced in this manner will sometimes last longer than a new one, as it is more flexible.

When the head of the wedge bolt is not a good fit in the wedge, so that the wedge can work up and stick or work down and pound, in case there are two bolts to each wedge, set it up where it belongs with one bolt and then pull the other one down to hold it there, so the wedge cannot work either way. If there is only one bolt—like the Baldwins—after putting tne wedge up properly, block it at the bottom end with a nut, if of the right size; or with a piece of hardwood, cut off the right length, to go between the bottom of wedge and binder. A piece sawed off an old coal pick handle does very well; there is room for it between the jaw and the bolt, so that it won't work out. The bolt should then be set to hold the wedge down solid on the block.

Steel boxes wear out and cut the cast iron wedges much faster than iron ones do. They are apt to stick with very little provocation. The steel boxes require more oil to keep them from cutting any other rubbing surface that comes against them.

A brass liner on the faces of shoes and wedges makes a good job and wear smooth, which cast iron against a steel box will not do. Therefore, you cannot run cast iron wedges as snug a fit against steel boxes as against cast iron or brass boxes.

The engines built by William Mason had two shoes, one on each side of the box, and inside of one shoe was the wedge; so that the shoe did not move up or down. The wedge was moved up and down by a bolt which was tapped up into the bottom end of the wedge. This wedge bolt had a collar about in the middle, which rested on the binder. The lower

part of the bolt came down through the binder. It had jam nuts to hold it when set, and a square head so it could be turned from below. To move the wedge up, the bolt was turned to screw the bolt out of the wedge. As the collar kept the bolt from coming down, the wedge had to go up. The wedge and all of the bolt above the binder being hidden by the shoe outside of it, made this arrangement a puzzle till a man saw one taken down.

A good many of the old country locomotives do not have any wedges. The jaws are parallel. Lost motion is taken up by slipping a liner of the proper thickness between the shoe and the jaw. Some companies have tried the same plan in the United States, but it does not give as good results as our plan of a wedge on one side. Possibly the fact that they are experimented with on heavy passenger engines, which, of all others, need the most delicate adjustment for lost motion at their boxes, has had something to do with their failure. Had this solid fixed wedge been tried on switch engines first, so that the machinists who make them, and repair men who are expected to keep them in order, could catch on to the troubles with their operation and learn the best methods of caring for them, possibly we would hear less of their failure.

Wedges are not a new invention. The writer ran some years ago a Rogers, Ketchum & Grosvenor engine that had two wedges for each driving box. This engine was at one time on the New York Central, then came to the Detroit & Milwaukee. Previous to 1854 she was named the "Empire."

The Reading Shops.

At Reading, Pa., are located the main shops of the Philadelphia & Reading system, and this implies a plant of some magnitude, for the Reading, while not long drawn out like the transcontinental systems, has lines radiating to almost all the points of the compass, with over 1,033 miles of road, and motive power comprising 791 engines. These figures show an unusually high ratio of engines to mileage, that is, 1.3 miles to each engine.

The erecting shop is a large one and well able to take care of a large equipment, having facilities for handling 60 engines at one time, while 50 is about the average number on the blocks. A peculiar and striking feature in connection with this erecting shop is the total absence of pits. The engines are lifted on the blocks high enough to work under comfortably, and from all indications there would seem to be no good reason why pits should be in existence in any shop.

The tracks on which the engines are placed for jacking up, are elevated about 10 inches from the floor, supported on cast iron brackets, which brings the rails on line with those on the transfer table that runs lengthwise of the shop, between the two erecting floors. This plan is seen to be an old one, but it does not suffer by comparison with the so-called modern shops except in one particular, namely, the want of head room to get in a traveling crane, but the want of this useful adjunct is not seriously felt witn the transfer table always available. And again, it is sometimes the case that other important interests are made to suffer in order to install the traveling crane, so that there is little else of use about the place, except crane. They seem to do very well without it here.

Another thing that takes one's thoughts back a few years is the location of the machine shop engine on the tool side, about the center of the line shaft, there being room left for the tools between one erecting floor and the wall. This all shows the passage of time since the plant was put in, but there are few of the new ones better able to take care of its work than this, for the reason that it is run on a present day basis. A heating arrangement by which the exhaust from the shop engine is utilized, has every appearance of efficiency as a heater without any of the back pressure objections usual to the attempt to round up heat units from that source. The exhaust is received in a 6-inch pipe, which runs completely around the shop and connects with the radiators from above. The immense radiating surface from an exhaust pipe of this size is no small factor itself in warming up a shop and has some advantages in the way of fewer joints, and in a lesser number of radiators of the regulation size. From the general air of ownership among the men, we should gather the idea that this was one of those shops where a man could not get a job until somebody dies, and we know of no higher tribute to the management of a road where such a state of things exists.

Mr. C. H. Quereau, master mechanic of the Denver & Rio Grande has issued a bulletin in which he says: "I would call your attention to the article on 'Burning Soft Coal Without Smoke' in the December number of LOCOMOTIVE ENGINEERING, page 547. It is well worth reading and putting into practice. I have known the writer, Angus Sinclair, for a number of years. He has not only had considerable experience, but opportunities for watching such matters all over the country. I also know from experience that the practice as explained is successful and economical."

FIG. 4. PUTTING BOILER IN PLACE.

During the past year many railroad companies in the West which have been balasting their tracks with burnt clay have adopted broken stones. The burnt clay craze has played out because the tendency of the material was to return to its original condition.

No decision has yet been arrived at about the place of meeting for the next railroad mechanical conventions. There was a meeting of the joint committees in December but they did not agree upon any place. Atlantic City, Old Point Comfort and Saratoga Springs were the favorite places talked about. A very vigorous effort was made to take the conventions to Denver, but "want of sufficient hotel accommodation" beat the friends of that movement.

The Royal Limited.

On November 20th a train de luxe, known as the Royal Limited, was placed in service between New York and Washington. This train consists of one observation parlor car, one parlor car, one cafe car and a dining car; all distinctively Pullman in design and finish, except in decoration and color, which latter features are after the Baltimore & Ohio Royal Blue service.

The observation, cafe and smoking car have the usual roomy platform which is so essential a feature of cars of this type. But it is the interior finish, in Circassian walnut, inlaid with satin wood, that causes favorable comment. It is doubtful if any grander effects were ever accomplished before in wood finish. A written description, however, is simply like a beggarly attempt to paint the lily. A peculiarity of this wood, however, is to closely resemble dark onyx when placed in shapes like columns, as in the case of those at the end doors, and also at the bulkheads. It is well calculated to deceive even an expert in fancy wood. The ladies' compartment is finished in vermilion wood, the so-called Indian red wood, while the draperies are blue and gold. A splendid cafe and smoking-room is one of the features of this car, and following that is one of the recent innovations in first-class train service, in the way of a ladies' retiring room, 6 feet square, which is fitted with a large dresser and full-length cheval mirrors—an addition to the usual accessories of the ladies' toilet that is a move sure to be popular. In this room the windows are oval in shape and have opalescent glass. The furnishings are in dark olive green.

The second and third cars are straight Pullman parlor cars in all particulars, but have a finish and decorations in harmony with the observation car. The dining car has a compartment about 20 feet in length at the forward end, done off for small luggage. The car seats thirty-two people, and is one of the best arranged for the purpose possible to devise. There is nothing plain about this car, notwithstanding the finish is in oak, a wood naturally associated with the dining room. The same striving after the beautiful is in evidence here as in the other cars of the train, and it looks as if the resources of the artist must be nearly exhausted.

All the cars are equipped with six-wheeled trucks, and have wide vestibules, and, in fact, everything that savors of luxury on wheels. The oval windows referred to, with opalescent glass, give an original and beautiful relief to what would otherwise be a dead panel space in the sides near the end and center. The conceit is a happy one in furnishing a means to not only relieve those blank spaces, but also giving us something new in window design for passenger cars.

FIG. 5. FASTENING THE BOILER.

Laws for the Laborer.

Some people who take a despondent view of human progress are always bewailing that the existing condition of society is tending to make the rich man richer and the poor man poorer, and that the poor man has no chance for justice when opposed by his rich neighbor. To find how far these complaints are true, it is only necessary to look back less than a century and examine laws in existence dealing with workmen.

In 1799 and 1800 the English Parliament passed the notorious "Combination Acts." By these laws, all combinations of laborers for the purpose of bettering their condition were declared illegal, and stringent penalties were provided for any violation of this principle. The mere act of a few independent workmen in agreeing with one another that they would not accept less than a certain rate of wages was judicially treated as a "conspiracy against the whole world," and punished accordingly. As late as 1834, some Dorsetshire laborers were transported to Botany Bay for the mere act of forming a labor union, which had committed no act whatsoever that could be construed as prejudicial to the public interest.

Record of the Atlantic City Flyer.

The Philadelphia & Reading Railroad passenger department have issued one of the most artistic illustrated pamphlets we have seen lately, giving a record of the sixty-minute trains of the Atlantic City Railroad run last summer. There is an excellent half-tone of the engine that did the work, of two of the trains and a variety of others, all produced in admirable style. The article written by Angus Sinclair describing a ride on the engine of the fastest train in the world, and published in LOCOMOTIVE ENGINEERING last August, is reproduced entire, also several other articles that appeared in home and foreign journals. A copy of the train dispatcher's sheet, showing exact running time of train is published, to which is added a statement showing number of cars in train, number of passengers carried and average number of miles per hour for each trip. That information will be valuable to the many people who interest themselves in the speed of railroad trains. We believe that those interested might obtain a copy of the pamphlet on application to the General Passenger Department, Reading Terminal, Philadelphia.

Some Steam Rudiments.

A good thing for the student in steam to get well incorporated in his mind is the fact that a pound weight of steam does not represent a pound pressure. If a pound of water is placed in a boiler and heat is applied until the water is turned into steam, that is, evaporated, there will be a weight of steam in the boiler equal to that of the water that was placed in the boiler, of one pound. The pressure will depend on the amount of heat that has been absorbed by the water; if the temperature of this pound of steam is 215.4 degrees Fah., the pressure will be one pound above the atmosphere, which will correspond to the pressure shown on the gage. At all other temperatures above this the pressure will be greater, for the reason that since the pressure is due to the temperature any increase in one causes an increase in the other.

Another point to bear in mind is the difference in the terms heat and temperature, as they are too often taken to be synonymous by the beginner in the study of steam. Temperature is measured in degrees, and heat is measured in units. The heat, or thermal unit, is the quantity of heat required to raise the temperature of one pound of water one degree, and the total heat of steam increases with the

temperature at the rate of 0.305 of a heat unit for each degree of temperature the steam is raised above 212 degrees Fah., which is the temperature at which water is evaporated at atmospheric pressure, at sea level.

The total heat of our one pound of steam at 212 degrees Fah., is 1146.6 units, which is the total heat of evaporation above 32 degrees Fah. The total heat at temperature T equals $1146.6 + [0.305 \times (T - 212°)]$, and for any other pressure, say 150 pounds by gage, for which the temperature is 365.7 degrees Fah., the total heat is equal to $1146.6 + [0.305 \times (365.7 - 212°)]$ equals $1146.6 + 0.305 \times 153.7 = 1146.6 + 46.88 = 1193.48$ thermal units. Thus in raising the pressure of the pound of water from one pound to 150 pounds, we have raised the temperature $365.7 - 212 = 153.7°$, and to do this have only put in $1193.48 - 1146.6 = 46.88$ heat units.

Traveling in Sewers.

There is a certain class of people who have a morbid pleasure in going into ghastly places, and they seem to find enjoyment from visiting scenes that are revolting to ordinary humanity. The last subterranean passage-way that might be expected to attract travelers is the inside of sewers, yet going through the sewers of Paris has become an ordeal which attracts many visitors to the French capital.

The main sewers of Paris are periodically cleared by means of scrapers carried on cars or boats. These conveyances are also used for conveying visitors through the larger sewers under the Rue de Rivoli and the Boulevards de Sebastopol and de Malesherbes. These expeditions take place fourteen times a year, in spring and autumn, and about 8,400 visitors are admitted yearly. Until 1894 these cars and boats were drawn by men, but the labor and expense were found to be so excessive that now the traction is entirely done by electric motors, taking current from accumulator batteries on the boats or cars.

These main sewers are in section very similar to an ordinary tunnel; but in the floor is formed the rectangular channel for the sewage, while round the roof are fixed the water and compressed air mains, the telegraph and telephone wires, etc.

The sewer under the Boulevard des Malesherbes is the largest. It is 18 feet 4¼ inches wide, 10 feet high from floor to roof, and the sewage channel in the floor is 3 feet 5¼ inches deep and 9 feet 10 inches wide. Boats are used in this channel. The other sewers are smaller, the channels in them being only 3 feet 11 inches wide, and from 3 feet 11 inches to 5 feet 7 inches deep. In these, cars are run, the flanged wheels of the cars running on the edges of the channel, which are protected by angle-bars and form the rails. The approximate weight of a train of five cars, with 100 passengers on board, is about 7 tons 12 cwt., and this travels at the rate of about 3½ miles per hour. The accumulator battery consists of 28 elements, and weighs 14 cwt., and its capacity is 100 ampère-hours, with a mean discharge of 25 ampères at 50 or 60 volts. The motor, which is series-wound, develops 2 horse-power, and runs at 1,600 revolutions per minute, this speed being reduced to 80 by means of a pinion and wheel and chain gearing to the driving axle, the wheels being 15¾ inches in diameter on the tread.

The boats are towed by means of a chain sunk in the sewage channel, which is brought to the surface and passes round a pulley driven by means of a double-reduction gear from the motor. The chain, by means of guide pulleys, makes three-quarters of a turn round the driving pulley, this pulley being a magnetic one, magnetized by means of two coils, one on each side of it on the axle. Each passenger train consists of six boats, in the first of which is carried the accumulator battery and a towing apparatus; while in the last boat, which is smaller, there is another towing apparatus. The battery consists of sixty elements, giving an output of 60 ampères for 2½ hours, at from 98 to 125 volts; it is divided into two parts, which can be connected in series or parallel as required. The motors run at 580 revolutions per minute; but this speed is reduced by means of the gearing so that the boats travel at about 1½ miles per hour. The power required for this is from about 2 to 5½ horse-power, according as the boats are traveling with or against the current.

The total length of sewers open in this way to the public is about two miles, and they are lighted partly by lamps on the footpaths, or by oil lamps on the boats. Americans who seem to have particularly strong objections to traveling underground in ordinary tunnels, are more given than any other nation to traveling through the tunnels of Paris. The experience is simply disgusting, but it seems to be enjoyed by people with an abnormal taste for novelty.

The First Cars Heated by Hot Water and Steam.

In the year 1865 Wm. C. Baker commenced erecting and putting into practical service in the cars of the then New York & New Haven Railroad Company, his non-freezing hot water car heater, the same as is now so much used in first-class passenger cars. The first heater was put in the director's car of the company, running daily between New York city and New Haven, Conn. The heater was soon adopted by the through lines from New York to Boston, *via* Springfield.

The plan of heating cars by steam from the locomotive, Mr. Baker inaugurated on the New York Elevated Railroad in the year 1878, as shown by the printed invitations sent to all the prominent men interested in the success of this, then, apparently chimerical scheme. Copy of the invitation follows:

"New York, March 22, 1878.

"DEAR SIR—You are respectfully invited to inspect a new arrangement for heating a train of cars by steam from the locomotive, now on the New York Elevated Railroad.

"For this purpose the management have kindly tendered a train for a special trip over the road. It will leave South Ferry

FIG. 6. READY FOR THE WHEELS.

station at 11:30 o'clock A. M. next Monday, the 25th inst. Yours truly,

"WM. C. BAKER, Inventor."

The plan was popularly ridiculed at the time, but after many rebuffs and discouragements, the inventor made the success that is now fully evidenced on the four lines in New York, as well as on other elevated roads outside of this city.

The first 700 elevated cars in New York city were equipped by Mr. Baker personally. This plan is simply to have live steam conducted through hose coupled together between the ends of the cars of the train, and through straight pipes, or loops, under the car seats. The size pipe usually used is 1¼ inches. A three-way cock at the rear end of the car relieves the water of the condensed steam; but, in practice, it is generally found that the so far unavoidable leakage at the couplings connecting the steam from one car to the other, is sufficient to free the condensation.

In the fall of 1881 several "composite" cars of the New York Central & Hudson River Railroad were equipped with steam heaters suspended underneath the car, supplying steam to a single 4-inch pipe run on the truss plank, each side within the car. These pipes were placed inclining towards the suspended boiler, so that the condensed water was at once reconverted into steam or returned to the boiler to become steam again. An automatic draft regulator controlled the fire. This system was soon after adopted by several other roads. The Pullman car "Western World," an unusually large car, running between Chicago and New York, was fitted with it, and gave satisfaction.

For street car heating, other than by car stoves, Mr. Baker first introduced a system of heating from a stationary source. This plan was a 4-inch wrought-iron pipe, run in a recess near the front edge of the long seat, each side of the car. This pipe was packed with sand, with space left for the introduction of a hot slug at one end, which was changed each trip at the terminal station, where there was a special furnace for heating the slugs. This was used on most of the cars of the Second and Third Avenue lines of New York city for several seasons. It was also adopted on the street cars in Providence, R. I. It was an efficient heater, but its disadvantages are apparent.

Many street cars are now being heated by the Baker heater in a modified form, the heater proper being placed in the vestibule or motorman's room, or underneath the car.

A patent has been issued Mr. Baker for the storage of heat from a hot-water tank under the car, similar to that for gas. This is to supply heat to radiators inside the car. He has also a patent for supplying heat from stationary sources along the routes of cars.

FIG. 7. GETTING WHEELS UNDER.

Correcting the Pitch of Long Taps.

Railroad shops in general are thought to be well provided for in the way of screw-cutting appliances when they have a few lathes of modern build having lead screws that are guaranteed to cut a thread within a reasonable limit of error in pitch. Such tools are accurate enough for railroad work in a general sense, and no one can register a "kick"; but for threading long staybolt taps, a corrective appliance or device has been gotten up at the Brainerd shops of the Northern Pacific, which are under the supervision of Master Mechanic Bean.

In investigating the range of accuracy of the new lead screw on their lathe used for tap work, it was found that an error of 0.012 inch in 36 inches was present in all taps turned out; to correct this screw, a device was gotten up that would advance or retard the carriage just that amount and would therefore cut a screw of a constant pitch. The corrective factor consists of a rod about 1½ inches in diameter, extending the whole length of the lathe on the operating side, with one end supported by a bracket, and the whole passing through a support bolted under the apron. This rod has a series of spiral grooves which are cut of such a pitch as will rectify any error of the lead screw.

This it does by having engaged in one of the grooves a spline in the support under the apron, this spline moving with the apron and carriage, and of course turning the rod an amount depending on the movement of the carriage and the pitch of the holes formed by the groove. The turning of the rod is communicated to the lead screw by an arm on the former, which in turn actuates a lever having connection with a friction disk through which the lead screw passes, and the latter is thus made to cut a slightly greater or less pitch than is due to the gears driving it, overcoming any error in the lead screw, whether less or greater than rated pitch.

An important feature possessed by this little scheme, is that of correcting the shrinkage of a tap after hardening, and this shrinking habit of taps, by the way, is a greater cause of error than that due to a freaky lead screw, more particularly if the screw is short in pitch. It will be seen that a tap may be cut just enough long so that shrinkage may be overcome to a nicety, and that with proper manipulation there can be but little error in pitches of the longest taps. This is the first tool of the kind we ever saw in use in a railroad shop, and from the results we witnessed there is no doubt about the value of it as a corrective device for long taps.

We receive complaints frequently that questions asked have not been answered in these columns. The reason of this probably is that the parties sending the questions did not give their name and address. Unless that is done we drop communications into the waste basket. That is a hole that quietly swallows many a letter.

When a report is made public that on some divisions a double nozzle is more economical than a single one, and that on other divisions the single nozzle comes out ahead, it may safely be concluded that more investigation is necessary to determine a matter that has very great influence on the economical consumption of fuel. Valuable information on this subject can be got from reports made to the M. M. Association.

The Hydraulic Testing Machine.

As everyone who has dabbled to any extent in machinery department affairs knows, there is more or less of an attempt to get at facts by the crudest contrivances, when from any reason it is impossible to have appliances specially designed for the work in hand. This statement is true of testing of material, transverse and longitudinally, for stiffness and ultimate strength, and also deflection, compression of springs, etc.

The hydraulic wheel press is a familiar example of the use of a tool never intended for such purposes as those cited, but it is an old standby in the measurement of heavy stresses, and probably as unsatisfactory in results as any that could be resorted to, if, as is generally the case with those machines, the packing is of the cup-leather kind. This packing has the merit of making a tight contact around the plunger, from the fact that it is U-shape in section, and is let into a groove in the cylinder bore, so that the inner diameter of the cup-leather is practically the diameter of the plunger.

Any pressure passing the plunger is therefore stopped at the packing, with the effect of forcing the same against the wall of the groove and also against the plunger. The intensity of this pressure of course measures the frictional resistance of the plunger, and takes from it a certain useful effect in its delivery of the force actuating it. This frictional resistance may be determined theoretically for any pressure P on the plunger, by multiplying it by a coefficient C, which it is evident must depend on the character of the surfaces in contact, and also the manner of loading the plunger, so that the amount of the friction may be expressed $F = C P$.

Engineering of June 15, 1888, describes some experiments on the friction of hydraulic jacks, from 3¼ to 13⅝ inches diameter, fitted with cup-leather packing. The friction loss varied from 5 per cent. to 18.8 per cent., according to the condition of loading on the plunger. With hemp packing, a plunger 14 inches in diameter showed a friction loss of from 11.48 to 3.4 per cent. with a central load, and from 15 to 7.6 per cent. with eccentric loads, the percentage of loss decreasing in each case with the increase of load. These experiments were made by J. E. Tuit, and are valuable in the one showing of the behavior of hemp packing under heavy pressures. A decrease in the friction with increase in pressure is certainly the opposite of results obtained with the cup-leather packing, the tendency of which is to remain constant for all pressures, or at least to increase, as far as knowledge of it so far has become public property.

With these facts before us, it is well to know something about the coefficient of friction of the packing before results are tabulated for future guidance. This is particularly true of tests of the strength of car and truck bolsters, in each of which cases we have figured, and have also made an attempt to verify calculated strength of springs by the means of a hydraulic machine designed for the purpose of doing this work. The data obtained was in every instance far short of the calculated figures, and indicated a coefficient of friction of not less than 15 per cent. in most of the cases followed up. Whether this friction was constant for all pressures we had reason to doubt, but there is no question that if the gage measuring the pressures could have been calibrated and graduated by a comparison with a machine known to be correct, that the results obtained would have been everything desired, even in testing material for tensile strength; this should be done in the interest of accuracy, and if properly done will place the hydraulic testing machine in the front rank for testing materials, from which it is now barred by the want of accurate knowledge of the friction loss in packing.

Explanations are hardly convincing, when a journal will run cool with the lightest lubricating oil, and on the contrary run hot in spite of the best bodied lubricant. The condition of the surfaces in contact are supposed to exercise the greatest influence in lowering the friction coefficient, and this theory, too, is sometimes shaken when a carefully scraped valve and seat will cut; while the same surfaces, raw from a file, will not evince any disposition to interlock the high points we know to cover both faces. The same can be said of the crank-pin bearing that gets a dose of emery.

It seems paradoxical to introduce an abrasive in order to lower the coefficient of friction, but that is the effect emery has on a journal, as many of our readers have no doubt demonstrated to their own satisfaction on a badly grooved brass. The theory of this action is, that emery will cut grooves in the surface of the bearings (and theory is not at fault here), these grooves forming channels for oil to flow more uniformly over the journal, than was possible with a lesser number of grooves. These are some of the points that make the hot-box question not easy of solution, and cause a great deal of speculation in cases that have the appearance of simplicity.

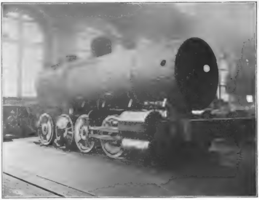


FIG. 8. READY FOR ATTACHMENTS.

Hot Journal Bearings.

There is perhaps as much mystery connected with the vagaries of a journal and bearing as in any other matter connected with mechanics. Reasons for the favorable performance of a brass are all plausible enough until the thing gets hot, and then explanations fall short of giving satisfaction. Car brasses have been tested with gradually increasing loads up to 4,500 pounds per square inch, with only 22 per cent. of the tests developing a tangible case of hot box. These same bearings ran cool on another occasion with a pressure per unit of area much higher than when they showed overheating, as if to further befog the expert. The same performance has been noted in driving boxes, which have run cool for months, and without warning begin to run warm with no apparent cause. The same thing is seen in crank pins.

Work has been commenced on the boring of the Simplon tunnel under the Alps. The power for operating the boring machines will be obtained from the River Rhone. When finished this will be one of the greatest tunnels in the world.

The telephone and telegraph cables in St. Louis have been rendered inoperative several times lately through rats gnawing through the insulating covering.

Curiosities of Piece Work.

Piece work in manufacturing has its good and its bad points, but it has come to stay like piece work in train service. The trend of industrial policy is to pay for work done, not for time spent in a shop or on the road. The first introduction of piece work into a shop always brings amazing surprises about the capacity of men. Everybody who has ever had charge of workmen has made the acquaintance of the rusher—the lightning mechanic. He is always on the jump and inspires an air of activity around him, but that is only while he is working by the day. When he is called upon to produce results as a basis of compensation he is the lowest paid man in the shop.

Another man whose performance brings surprises under the piece work test is the quiet apathetic workman who plods along and never seems to be doing his best. During the day work period, you fume and make mental complaints about that man because you cannot instill some activity into his movements, but you cannot say that he is idling or wasting his time, and so you just tolerate him and think you deserve special credit from on high for not discharging him. But when the piece work system was inaugurated you found that the slow man kept on in his slow ways—did not make a movement faster than usual, but to your astonishment, at the end of the week, you found that he had earned more than any other man in the shop. That teaches you a lesson not to judge by appearances.

The first maker of railway appliances that we know of to introduce a piece work system was John Stephenson, car builder of New York, and it was done before car work proper was in demand. There was something of a boom in the demand for stage coaches and the Stephenson works were sorely pushed to meet orders. The controlling department of the Stephenson establishment at that time was the sash room, which was small and was always behind, although two men and a boy were working nearly night and day to supply the demand of the other departments. It was inconvenient to find a room where more men could be employed on this work, and Stephenson decided to try piece work, and after calculating what each sash was costing him, intimated to the men in charge of the sash room that all work in future would be paid on a piece work basis. The new system had no sooner gone into operation than the man in charge discharged his assistant, and with the help of the boy made all the sashes required, without working overtime. That man was probably an arch enemy of labor interests, for his performance immediately led to the introduction of piece work into every department of the works.

Our "Book of Books" tells you where good reading can be found.

A Novel Car Frame.

A patent has been taken out for a double hopper bottom gondola car, which is framed on the old familiar lines of plates, sills and side stakes, with twin hoppers below. There are some entirely new fancies worked out to give strength to the framing (always weak in this type of car), by putting sheet metal on the side of the frame as a stiffener. The difficulty of trussing such a car is well known, since the central portion is taken up by hoppers. In this case the simplest form of a truss is used, consisting of two diagonal braces and a tie-rod. The feet of the braces rest on the body bolsters, and the tops of same abut just above the coal sides, from which point the tie-rod passes down between the hoppers at the center of the car. This construction supports the major part of the load coming between the bolsters by means of the truss, which makes a good stiffener in absence of truss rods, and it is open to question whether the latter method is as good as this.

There is a growing agitation in Great Britain in favor of legislation to compel railway companies to adopt automatic couplers that can be operated without requiring the train men to go between the cars. With the side buffers almost universally used in Europe the automatic coupler presents more greater difficulties than it did on this continent, and the dangers of coupling are greater.

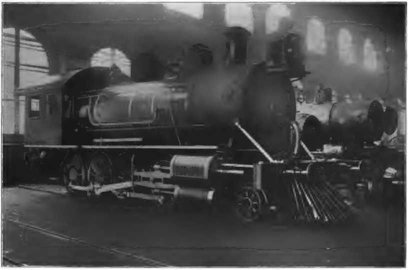


FIG. 9. READY FOR THE PAINT SHOP.

PERSONAL.

Mr. Charles Treble has been appointed foreman of the locomotive and car department of the Dayton & Union at Dayton, O.

Mr. F. B. Lincoln has been appointed superintendent of the Tioga division of the Erie at Elmira, N. Y., vice Mr. E. E. Loomis.

Mr. F. O. Miller has been appointed engine dispatcher of the Cincinnati, Hamilton & Dayton, with headquarters at Cincinnati, O.

Mr. N. E. Sprowl has been appointed master mechanic of the Central Railroad of New Jersey, with headquarters at Elizabethport, N. J.

Mr. O. O. Winter has been appointed general manager of the Brainerd & Northern Minnesota, with office at Brainerd, Minn., succeeding Mr. E. H. Hoar.

Mr. L. L. Dawson, master mechanic of the Illinois Central, at Memphis, Tenn., has been transferred to McComb City, Miss., succeeding Mr. W. B. Baldwin, deceased.

Mr. W. H. Taylor has been appointed master mechanic of the New York, Susquehanna & Western, with office at Stroudsburg, Pa., vice W. C. Ennis, resigned.

Mr. A. F. Seltzer has been appointed master mechanic of the Ferrocarril Michoacan y Pacifico, with headquarters at Zitácuaro, Mexico, vice Mr. E. W. Knapp, resigned.

Mr. F. O. Melcher, chief engineer of the Fitchburg Railroad, has been appointed superintendent of the Fitchburg division of that road, with headquarters at Boston, Mass.

Mr. R. M. Boldridge has been appointed master mechanic of the Southern Railway in Kentucky, with headquarters at Louisville, Ky., in place of Mr. J. B. Gannon, transferred.

Mr. J. F. Bowden has been appointed general foreman of the Trinidad shops of the Baltimore & Ohio, near Washington, D. C., succeeding Mr. J. E. Hobbs, transferred to other duties.

Mr. N. E. Clucas, for several years foreman of the Atchison, Topeka & Santa Fé at Pueblo, Col., has been appointed master mechanic at La Junta, Col., vice Mr. John Forster, resigned.

Mr. H. A. Ford has been appointed trainmaster of the Kansas City, Memphis & Birmingham at Amory, Miss. He was formerly superintendent of the South Florida division of the Plant System.

The headquarters of Mr. Hugh Spencer, superintendent of the St. Paul & Sioux City division of the Chicago, St. Paul, Minneapolis & Omaha, has been removed from Mankato to St. James, Minn.

Mr. J. T. Stafford has been advanced from the position of general foreman of locomotive repairs of the St. Louis, Iron Mountain & Southern, at Baring Cross, Ark., to that of assistant master mechanic.

Mr. W. O. Templeton, formerly roundhouse foreman at Perry, Iowa, with the Chicago, Milwaukee & St. Paul Railroad, has accepted a similar position with the Baltimore & Ohio Railroad at Pittsburgh, Pa.

Jacob H. La Rue, the oldest engineer in the employ of the Cincinnati, Hamilton & Dayton, died suddenly of heart paralysis one day last month, as he was preparing to take out his engine with a passenger train.

Mr. J. H. Manning, master mechanic of the Omaha shops of the Union Pacific, has been transferred to the Wyoming division, with office at Cheyenne, Wyo., vice Mr. T. A. Davies, transferred to other duties.

We are dependent to a great extent upon our friends sending us notifications of official appointments, and we would like very much to have them notify us of any changes that take place in mechanical departments.

We have several good master mechanics on our list who are open to engagements. The names of none but good ones are kept on our list. If you need an efficient man for any of these positions let us know.

Mr. Clinton B. Conger, for many years road foreman of engines on the Chicago & West Michigan, has resigned to become associate editor of LOCOMOTIVE ENGINEERING, with headquarters at 95 Liberty street, New York.

Mr. P. J. Harrigan, general foreman of the Connellsville shops of the Baltimore & Ohio, has been promoted to the position of master mechanic of the middle division, with office at Cumberland, Md., vice Mr. D. C. Courtney, resigned.

Mr. M. K. Barnum, master mechanic of the Union Pacific shops at North Platte, Neb., has been transferred to the Nebraska division, with headquarters at Omaha, succeeding Mr. J. H. Manning, transferred to the Wyoming division.

Mr. Willard A. Smith, of Chicago, who was chief of the transportation department at Columbian Exposition, has been appointed to hold a similar position in connection with the United States exhibits at the Paris Exposition of 1900.

The business men of Baltimore displayed their high esteem for Mr. Wm. M. Greene, lately appointed vice-president of the Baltimore & Ohio Southwestern, by tendering him a farewell dinner on November 25th, and presenting him with a handsome silver loving cup.

Mr. C. L. Mayne, general superintendent of the Fitchburg, has resigned. He went with the Fitchburg in January, 1892, as superintendent, after which he was made assistant general superintendent, and was appointed general superintendent in September, 1897.

Mr. E. E. Loomis, superintendent of the Tioga division of the Erie Railroad, has been appointed general superintendent of the New York, Susquehanna & Western and Wilkesbarre & Eastern, succeeding Mr. C. D. McKelvey, resigned; headquarters at Jersey City, N. J.

Mr. J. R. Reniff, master car builder of the Lake Shore & Michigan Southern at Norwalk, Ohio, has resigned, and the car shops at that place will be closed. Master Car Builder G. N. Dow, at Cleveland, has had his jurisdiction extended over the territory heretofore looked after by Mr. Reniff.

The jurisdiction of Mr. J. H. Sullivan, superintendent of the Kansas City, Memphis & Birmingham Railway, has been extended to cover the Ozark and Arkansas divisions of the Kansas City, Fort Scott & Memphis Railway, succeeding Mr. R. R. Hammond, division superintendent, promoted.

The following changes have been made on the Wabash: Mr. George W. Mudd, master mechanic at Springfield, Ill., has been transferred to Moberly, Mo., vice Mr. George S. McKee, transferred to Fort Wayne, Ind., to succeed Mr. C. H. Doebler, who is made master mechanic at Springfield.

Mr. Joseph Dugan, who resigned as locomotive engineer of the Pan Handle road to enter the navy when war broke out, has been honorably discharged and has gone to work on the Cleveland & Marietta Railroad. He acted as engineer on the United States steamer "Chicago" and made a good record.

Mr. Mord Roberts, master mechanic of the Arkansas division of the St. Louis, Iron Mountain & Southern at Little Rock, Ark., has had his jurisdiction extended over the Missouri division, with headquarters at De Soto, Mo., owing to the resignation of Mr. W. H. Harris as master mechanic of the latter division.

Mr. Harris Tabor, the well-known mechanical engineer, and president of the Tabor Manufacturing Company, has just returned from a trip to Europe which was made in the interests of his company. He found the Tabor molding machine making rapid progress into favor, especially among the English engineering works. These people are more than pleased when the machine turns out half the work it has to do in our foundries.

The motive power department of the Baltimore & Ohio Railroad has made the following changes, effective December 1st: P. J. Harrigan has been appointed division master mechanic, middle division, with headquarters at Cumberland, vice Mr. D. C. Courtney, resigned; David Witherspoon has been appointed general foreman at Connellsville, Pa., vice Mr. P. J. Harrigan, promoted; J. F. Bowden has been appointed general foreman at Trinidad, near Washington, vice J. E. Hobbs, assigned to other duties.

George G. Gardner, traveling engineer for the Pittsburgh Locomotive Works for the past eight years, died at Eldorado, Mo., Dec. 9th, at 4 o'clock, aged 59 years. Mr. Gardner was delivering some new engines to the Missouri, Kansas & Texas Railroad at Parsons, Kas., when he took sick. He was a prominent Brotherhood of Locomotive Engineers member, also a mason in good standing for many years. The funeral took place at Columbus, O., where the deceased formerly lived. He was at one time an engineer on the Columbus, Hocking Valley & Toledo Railroad, and was respected by all who knew him.

General Superintendent William Gibson, of the Baltimore & Ohio, knows all his men and speaks to all of them on his trips over the road, or through the yards, calling them by name. These little acts show the true gentleman better than the haughty and assumed dignity put on by some other officials on other lines, who are wont to swell up in their vainglorious, false dignity and use their men like slaves. The Baltimore & Ohio employés are better men and more faithful servants since Mr. Gibson took charge and they all respect him more for his gentlemanly manners. At the same time they have learned to know that the rules must be strictly obeyed, and that no negligence or carelessness will be tolerated for an instant.—*Pittsburgh Post.*

On December 1st the office of superintendent of the Kansas City, Fort Scott & Memphis Railway was abolished, and that of general superintendent created instead. Mr. R. R. Hammond, division superintendent of the Ozark and Arkansas divisions, was appointed general superintendent by the president, Mr. Edward S. Washburn. The general superintendent will have charge of the operating department, maintenance of way, bridges, buildings, etc., from Kansas City to Birmingham. This promotion, a most deserving one, is the reward of patient, painstaking meritorious service and a high personal character. Advancing through the gradations of telegraph operator, dispatcher, and division superintendent, a close student of detail, Mr. Hammond is eminently qualified to fill this responsible position.

The question is not new, "Oh, what is fame?" In the report of a railroad club, our friend Mr. S. M. Vauclain, whose location the world needs not to know, was described of the Baltimore Locomotive Works. There is some Latin phrase that does the subject justice, but we cannot think of it with the shadow of the great fire upon our memory.

Mr. Howard Curry has been appointed road foreman of engines on the Northern Pacific, with jurisdiction on lines east of Livingston. A long career of usefulness on this road has been rewarded with this evidence of confidence by the management, and those who know the appointee have no fear that the best interests of the road will not be well served.

We understand that the chief office of the Delaware, Lackawanna & Western, which from the inception of the road has been at Scranton, is to be moved to New York, and that Mr. Halstead, the general manager, will remove to the city named. We sympathize with Mr. Halstead in the necessity for changing from a rural center to a great metropolis and crowded railroad entrepot; but we understand that he views the change with entire complacency.

Since we last went to press, the news has come to us of the death, in England, of Joshua Rose, who was once well known in this country as a maker of books. Mr. Rose was an English machinist who came to this country about thirty years ago and went to work at his trade. Although he was not an educated man, he had the faculty of perceiving things that mechanics would like to see discussed, and he began contributing his views to various mechanical papers. Then he got to publishing books which were to a great extent collections of engineering data, but the business seemed to pay, for the earnings from them enabled him to retire to a life of leisure in his native country.

There was quite a voting contest among the employes of the Pennsylvania Railroad for members of the advisory board of the Voluntary Relief Association. Mr. W. R. Jones, an engineer on the Pittsburgh division received the largest number of votes. The votes were as follows: W. R. Jones, 3,814; George W. Brown, 3,793; John W. Craig, of Harrisburg, 3,716; Samuel T. Lowery, 2,037; Walter S. Irvine, Juniata shops, 1,449; Benjamin F. Huber, 1,127; Charles J. McCarthy, 993; and A. J. Campbell, 86. There were 223 scattering votes. The other members of the board will be: James D. Lewis, United Railways of New Jersey; Zachary T. Moyer, Philadelphia & Erie, who received 1,194 out of 3,102 votes; C. A. Wood, Northern Central; D. F. Troy, Philadelphia, Wilmington & Baltimore; James L. Curtis, West Jersey & Seashore. They will serve for one year from January 1, 1899. John H. Kepperley was second in the race on the Philadelphia & Erie, receiving 747 votes.

We understand that Mr. J. W. Thomas, president and general manager of the Nashville, Chattanooga & St. Louis, has retired, and that his son Mr. J. W. Thomas, Jr., takes his place as general manager. There have been few railroad officials who have done more for the interests of the property under their charge than that performed by the elder Mr. Thomas. From what we have seen of the property, we always considered that he was an ideal manager, not only for those who were looking for returns on their investment, but for every individual employé engaged in the operating of the road. His son is certainly a worthy successor and his training did great credit to the good sense of the father. Young Mr. Thomas learned the machinist trade, fired locomotives and was a locomotive engineer for five or six years. From that position he went up step by step until he reached the position of assistant general manager. In that position he was very successful indeed, and under his careful supervision of details the Nashville, Chattanooga & St. Louis came to be one of the best operated railroads on this continent. Mr. J. W. Thomas, Jr., has the inventive faculty highly developed. An automatic pneumatic blocking signal system which he invented and developed would have made any common railroad man famous.

EQUIPMENT NOTES.

The Boston & Albany are to have 300 cars from the Union Car Company.

Three consolidations are under way at Baldwin's for the Mexican National.

The Louisiana & Arkansas are having one-six-wheel engine built at Baldwin's.

Ten consolidations are under way at Baldwin's for the Philadelphia & Reading.

The Schoen Pressed Steel Company are building 1,000 cars for the Baltimore & Ohio.

The Erie are having 3,000 freight cars constructed by the Michigan Peninsular Company.

Thirty six-wheel connected engines are being built for the New York Central at Schenectady.

The Monterey & Mexican Gulf have ordered one six-wheel connected engine from Baldwin's.

The Terre Haute Car Company are building 100 freight cars for the Chicago & West Michigan.

The Louisville, Henderson & St. Louis are to have ten passenger cars from the Ohio Falls Company.

The Manchester Locomotive Works are building one standard engine for the Montpelier & Wells River.

The Rogers Locomotive Works are building two six-wheel connected engines for the Marianoas Railway.

Two standard engines are under construction at the Schenectady Locomotive Works for the Maine Central.

The Pittsburgh Locomotive Works have twenty-five engines under construction for the Baltimore & Ohio.

The South Baltimore Car Works are working on an order for 500 freight cars from the Monongahela Railway.

(*Equipment Notes continued on page 59.*)

Great Northern of England Express Engine.

The locomotive shown in the annexed half-tone, made from a photograph sent us by Mr. F. Moore, our London agent, is one of the most recently built engines, and its single pair of driving wheels indicates how tenaciously some of our British friends cling to that form of locomotive design. The engine was built at the shops of the Great Northern Railway at Doncaster, from designs prepared by Mr. H. A. Ivatt, locomotive superintendent of the road. The cylinders are 18 x 26 inches, and the driving wheels 90 inches diameter. The boiler is 53 inches diameter and 11 feet 4 inches long, the center line being 8 feet 3 inches above the rail, which is high for an English engine. The total heating surface is 1,268 square feet, the grate area being 23 square feet. We find these details in *The Locomotive Magazine*, of London.

except a rotary plow, and President Baldwin was the first in getting one of these fine machines at work, after which, to open the road meant simply the time required to run the plow over it.

The rotary snow plow comes high, but there is economy in their use when the loss of traffic due to two or three days of a tie-up is considered. There were several roads in this section powerless to turn a wheel for some little time after this late blizzard, and so far as we learn, the Long Island was the only road enterprising enough to purchase one of the machines. As a matter of fact, it was largely a question of luck that this machine happened to be in stock, for it is not usual to build them except on order. These storms are so infrequent in the East, that railroad companies hesitate to lock up the price of a rotary, which is, or was, about $20,000; but the lesson of a few such storms as the last may cause such a purchase to be evidence of a clear understanding that money can sometimes be made by its withdrawal from the usual channels of trade.

The Northern Pacific has given good evidence of its faith in such an investment, by being first in the field with these plows, having eight of them in commission, and it is a road that has little more to fear from snow than those in the East, except perhaps on the mountain districts. This is contrary to the general conception of the situation; but as a matter of fact, while low temperatures prevail, the road runs through a zone remarkably free from snow.

Through the courtesy of President Baldwin, of the Long Island Railroad, a representative of LOCOMOTIVE ENGINEERING was sent out by a special train to find the rotary plow, and then the greater part of a day was spent inside of its machine house or watching its operations from outside. The snow was so hard that persons walked on the top of it without making much mark, but the machine sliced its way through cuttings that were about 15 feet deep. We regretted all day that we had no camera along to take a photograph of the rotary at work, but fortunately there is a picture on page 6 of this issue showing a rotary at work in Colorado, which is a good picture of what was seen within twenty miles of New York last month.

Our friend, Mr. W. F. Dixon, of Sormovo, Russia, saw in a St. Petersburg paper a notice that the upper part of the Home Life Insurance Building was burned out, and he immediately wrote us a warmly worded letter of sympathy. It concludes: "The stoppage of LOCOMOTIVE ENGINEERING and of the *American Machinist* in one fell swoop will affect us more than did the war with Spain." Mr. Dixon had not learned that the *American Machinist* had escaped the fire by moving out a fortnight before it happened.

GREAT NORTHERN OF ENGLAND EXPRESS ENGINE.

The Lesson of the Blizzard.

The snow blockade of last month on the Long Island road was one of the worst ever experienced in that section. The hurricane which accompanied the snow fall packed the snow so hard that a wedge plow was of no more use than a carpet sweeper. In fact, the large double-track plow which was sent out to "buck" it, was destroyed by impact with the frozen drifts, and not only this, one engine of the five which were pushing the plow was badly wrecked in the smash, the conductor was killed, and the engineer seriously injured. The destruction wrought in this case will give some idea of the resistance offered by hard-packed snow.

There is nothing on earth that will make any impression on a blockade of this kind,

Somebody has worked to no purpose in squandering time wherewith to devise a railed enclosure for the tops of box cars, the intent of which is to make a safe passage way for trainmen. A snowball in the rays of a tropical sun would last as long as one of these. A self-respecting "shack" would see that it figured as a part of the landscape if he had to subject himself to the humiliation of being penned in on top of a car by an arrangement so strongly resembling a cattle chute.

"Imperceptible" Slip of Locomotive Driving Wheels.

So much has been said and written from time to time about the slipping of the engine driving wheels when the steam is shut off that more at this time may seem superfluous. It is not the purpose now to discuss the question further, but to give the summarized results of an elaborate and carefully conducted series of tests made by Messrs. John W. Ackerman and William H. Wardwell, two seniors in mechanical engineering in Cornell University, to ascertain whether the theory be true, and to what extent.

Ackerman and Wardwell note that the experiments of M. Rabeauf, a French railroad engineer, show that with fast passenger locomotives running at high speeds, imperceptible slip as high as 19 per cent. occurs on down grades. Further investigation by M. Rabeauf gives values of slip varying from 13 to 25 per cent. on down grades, and scarcely any perceptible amount on up grades.

Then studying the other side of the question, these students observe that Wellington, an American engineer, denies positively that such a thing is possible, and writes in his "Economic Theory" as follows: "As a result of these tests (made by M. Rabeauf), it was concluded that common locomotives were actually unsuited for high speeds of 60 to 75 miles per hour, because the slippage was as high as 20 per cent. On the other hand, tests of various American passenger locomotives at high speeds of 75 miles per hour, made by Prof. Chas. A. Smith and others, have uniformly indicated that no such phenomenon occurs with American locomotives under any circumstances."

Wellington further says: "There is an undoubted possibility, so far as this evidence alone is concerned, that the phenomenon might not occur with American locomotives, and might occur with differently constructed foreign locomotives; but in addition to the grave reasons for questioning the physical possibility of the assumed phenomenon, as being contrary to what is known in other ways of the laws of friction, it is not difficult to see how the alleged slipping may have occurred, and yet have been in no respect 'imperceptible' slip, nor different in any way from ordinary slipping, which is perceptible enough.

"When a locomotive is only moving itself, especially if running down a grade, and having so little work to do, and when all possible power is put on to run, in literal truth 'as fast as the wheels can turn,' whether the wheels are slipping or not, will make no very conspicuous difference in the speed of the revolution. With a train of even one car behind the engine, no high speed could be maintained under such conditions, for the minimum power to maintain the speed would then be so great that the speed would be immediately checked, and make it clear to the senses that the wheels were slipping. When the locomotive was running up any considerable grade, it would be still less perceptible."

These differences of opinion in regard to this matter prompted Ackerman and Wardwell to make these tests to determine if possible, in this particular case, whether or not there existed any "imperceptible' slip, and to what degree. Their tests were made in May, 1897, on the Cayuga division of the Delaware, Lackawanna & Western Railway, between Ithaca and Owego, a distance of 34 miles. The locomotive used was the "General Wells," whose pertinent dimensions were as follows:

Total wheel base—21 feet.

Center to center of drivers—7 feet 4½ inches.

Circumference of drivers—15.82 feet.

Weight on drivers—48,500 pounds.

Total weight of engine—72,300 pounds.

Diameter of cylinders—15¼ inches.

TESTING SLIP OF DRIVING WHEELS.

Length of stroke—33½ inches.

Steam pressure—130 pounds.

Total weight of cars hauled—95,000 pounds.

The principal apparatus consisted of two Thompson indicators, two revolution counters and one Boyer speed recorder.

To determine accurately the circumference of the drivers, the locomotive was run out on a long stretch of straight, level track, where, by means of pinch bars, the engine was so set that a prick punch mark on the driver was exactly one foot from another similar mark on the frame. These marks were the same that were used for setting the valves. Trammel points were used to set the wheel accurately. Then a plumb line was dropped across the center of the driver, and the track was marked with a chisel to correspond. The engine was then run forward seventy-four revolutions. This distance was gone over very slowly, so that there could be no slip. The punch marks were set as before and the track marked. Then the distance was carefully measured with a 100-foot steel tape, and the distance was divided by the number of revolutions the driver had made in traversing it. This gave the circumference sought very accurately as 15.8277 feet. This measurement was checked very closely by running a tape around one of the drivers.

When the engine was drawn up in front of the Ithaca station to leave, the rail was marked corresponding to the center of the wheel. When the train arrived at Owego, the wheel was set by trammel points and plumb line, and the track chisel-marked as at Ithaca. Then the final readings of the revolution counters were taken. In making the return trip similar marks at Owego and Ithaca were taken as before. These marks, with the record of the revolution counters, proved that the drivers made precisely the same number of revolutions going and returning.

Several trips were made, speed rates as high as 65 miles per hour being attained, and the distance between Ithaca and Owego, as recorded by the revolution counters on the drivers, proved to be almost precisely the same in all cases. The greatest variation being obtained was 8 inches in the total distance of 34 miles; that is, the revolution counters registered the distance 34 miles and 8 inches, instead of the true distance of 34 miles. In other words, the drivers slipped forward 8 inches in the 34 miles. There is nothing remarkable about the result except that 8 inches slip in 34 miles is an exceedingly small amount and less than would be ordinarily expected. If there was any "imperceptible" slip while the engine was running shut off down grade, it was offset by

a similar amount of back slippage while the engine was climbing up grade or running over levels, which is impossible. There was no skidding of wheels in making stops, as the engine had no driver brake and was not reversed.

The small slippage of 8 inches in 34 miles was undoubtedly caused by the pulling action of the driving wheel on the rail; and the tests of Ackerman and Wardwell proved, in this case, that there was no "imperceptible" slip of the driving wheels.

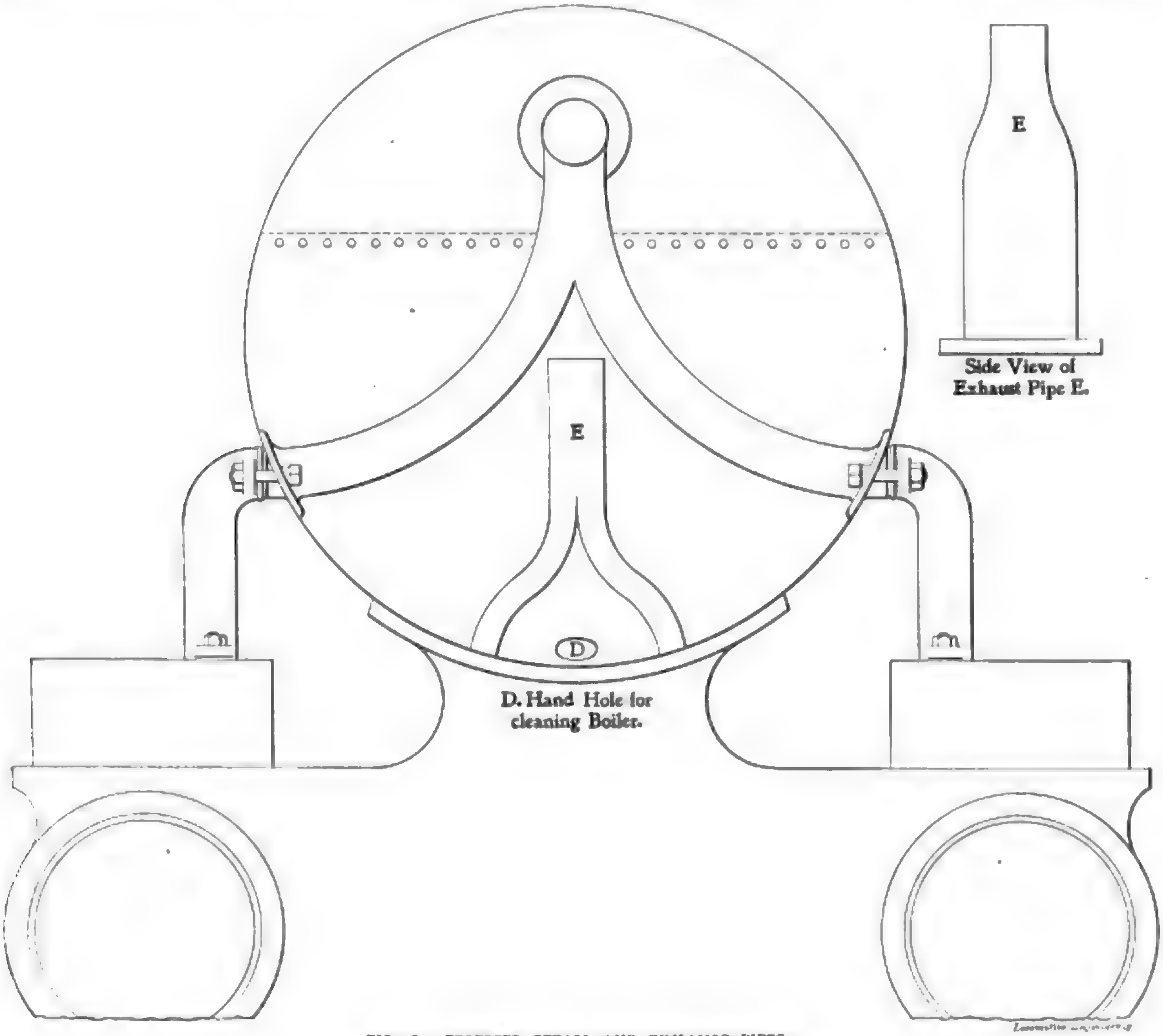


FIG. 2. PROPOSED STEAM AND EXHAUST PIPES.

Steam and Exhaust Pipes.

R. E. MARKS.

I've been thinking about steam pipes a good deal lately, probably because I've had lots of extra work from their coming loose or leaking, and it seems to me there is a fine chance for improving several things about steam pipes, and incidentally, exhaust pipes as well.

Take Fig. 1 and see the right hand pipe, the kind we use regularly. Is it any wonder they come loose and leak at the lower joint? Only wonder is they don't leak more at the upper one. Here we have a curved cast iron pipe weighing several pounds at least, and a leverage of from 12 to 15 inches in ordinary cases. Every surge of the engine backwards or forward tends to loosen the pipe, and generally succeeds.

As far as the loosening of joints goes, the left hand pipe ought to be better, as the leverage for swinging is left out in the cold. It has another advantage, too. It leaves the outer flues free from obstruction, which will reduce their clogging and allow them to be cleaned more readily when they do clog. The draft is weakest in these flues and needs encouraging in every way, as this will obviate some of the difficulties now experienced from this cause.

One of my friends, who has also had the steam pipe disease to look after, suggests an even more radical change and backs it up with pretty sound arguments. His scheme is shown in Fig. 2.

The steam pipe is a Y coming down from the dry pipe head to the boiler shell, the ends being turned on a boring mill to the radius of the inside of the shell, but not for making the steam joint, only to get a good bearing and make a good job. The steam joint comes outside, as shown, and is held by two good-sized bolts. In this design there would be nothing to loosen joint, but should it become leaky it is easily detected and repaired without waiting for engine to cool down before going to work. Of course, the pipe would not be left bare, but would be covered with a good sectional non-conductor. This gives the same freedom of draft and access to outside tubes as Fig. 1, and has the advantage of having the joint outside the smoke arch.

The exhaust goes up through the saddle and out the exhaust pipe, which is divided at its base for the purpose of allowing access to bottom of boiler through hand hole *D*. Some of the æsthetic individuals may not like the departure from the usual method and will probably decry the appearance of the pipes outside. But they can be thoroughly protected with very

little difficulty, and there is a good field for design in a neat and effective covering for them. If any of the steam joint doctors have a better remedy, I, for one, would like to know of it.

Booting Train Disturbers.

In connection with the maintaining of order in the new possessions secured by the United States, railroads may be made to play an important part, and there are precedents for believing this to be practicable. About fourteen years ago there was a revolution in Colombia, South America, and the revolutionists were inclined to interfere with trains on the Panama Railroad. To prevent this, United States marines were landed to protect American interests. On each road there was put an armored train containing fighting material and a good supply of blue jackets. Marines were also posted in different parts of the train. They were directed not to use their guns unless forced to do so, but to make the best of their boots as weapons when that form of carrying on warfare was effective. It generally was. Many an insurgent who boarded a train to make trouble was badly troubled for days afterwards by the wounds inflicted by the boots worn by the United States marines. It gave rise to a saying that guns missed their aim, but that the boot of a marine hit the mark every time. When it was necessary to hang an insurgent, a flat car was found to make a good drop when pulled from under.

The Corrupting Present.

In his well earned retirement to a life of ease and leisure, Mr. M. N. Forney, appears to be devoting a great deal of attention to the study of the Holy Scriptures. In a paper read before the New York Railroad Club, he gave a great many Scripture texts on which to base sermons of a moral character.

One text which seemed to please him very much was taken from Ecclesiastes—"Presents and gifts blind the eyes of the wise, and stop up his mouth that he cannot reprove." The personal application which he gave to that text was:

"An instance of bribery which would be amusing were it not that the resulting evils of the practice are so great, was related some years ago. A certain manufacturer of car axles made a journey up into the Northwestern part of the country, which was then just being opened up by new railroads, to secure an order for his products. He arrived at his destination on Sunday morning, and having nothing else to do, called at once on the master mechanic, who he found was a zealous church member, and who invited our axle man to go to church, which he did. Whether he repeated from the Collect the words, 'Thou who knowest us to be set in the midst of so many and great dangers, that by reason of the frailty of our nature we cannot always stand upright,' etc., was not reported; but in the afternoon he accepted another invitation to attend Sunday school, of which the party who controlled the order for the axles was superintendent. Our axlemaker found that a penny collection was being made to buy a library for the school. The next day he learned that the order was not quite ready to be given out. On his return home, to expedite matters, he bought a whole library, and presented it to the Sunday school, and, as he subsequently remarked, he got an order for four hundred axles, at a quarter of a cent a pound more than the market price."

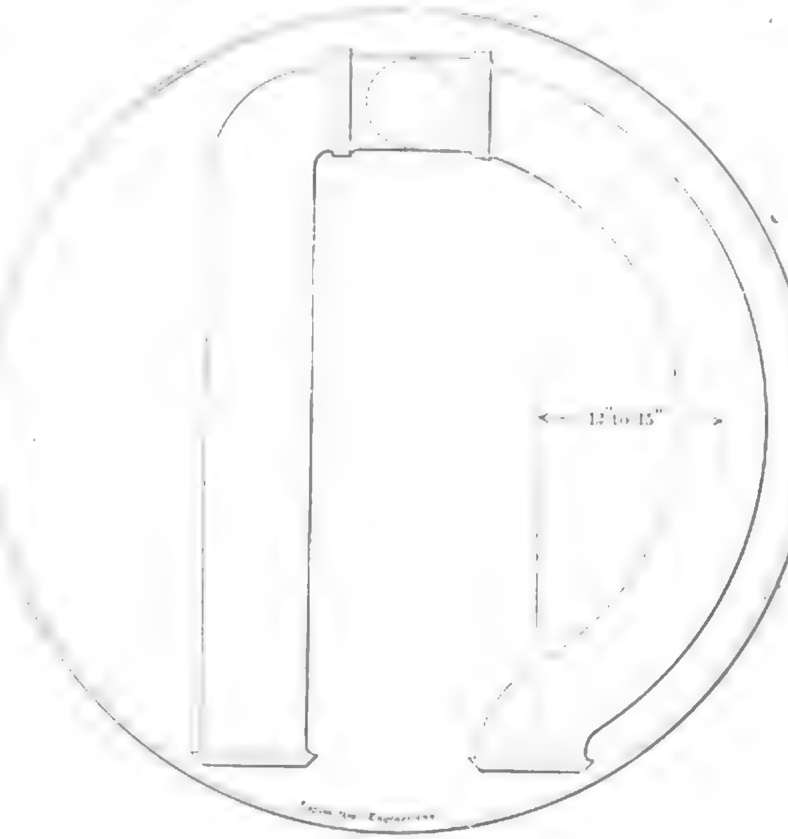


Fig. 1

STEAM PIPES—A SUGGESTION.

Driving Springs—Effect in Riding of the Engine.

Among the observations made on some of our representative roads by Mr. W. W. Acworth, an English authority of eminence in foreign railway affairs, we note his reference to the smooth riding of our engines as compared with those of the English lines, "whether the cause be their more flexible frames, their equalizing levers, or possibly even the more elastic permanent way, do indubitably ride more smoothly than our English locomotives."

There is no doubt that the factors mentioned all have an influence in the direction of easy motion, but there is one very important cause for the performance of our engines so favorably commented on, namely, an elastic spring, and this in connection with the equalization of load between drivers is the prime cause for the superiority in riding of our engines over those not possessing these features of suspension, which are the strong points of the American locomotive builder.

A spring must have a certain degree of flexibility in order to reduce the effects of shock due to rough track and low joints to a point that will be safe for both the engine and rails, since action and reaction are equal. To this fact may be attributed the care taken by the American locomotive designer, to give such elasticity to springs as will prevent hard riding and still retain the proper strength to safely carry the load, a problem involving some niceties of calculation and the exercise of a judgment tempered with considerable experience.

Several important extensions will be made by the Colorado Southern during the coming summer. It is intimated that the company is going after traffic in cattle, coal, fruit and minerals of the valley of the Gunnison and other rich valleys of the region.

A circular from the Massachusetts Institute of Technology says that it costs, on an average, $330 per year for the instruction of students. A student pays $200 a year, leaving $130 to be met by the Institute. As the Institute averages close on [illegible] students, it leaves a pretty big hole to be filled up.

Delaware & Hudson Consolidation Engine.

The consolidation locomotive here shown with wide firebox and cab on top of the boiler was recently built for the Delaware & Hudson by the Dickson Locomotive Works. The engine was designed for burning slack anthracite. The total weight of the engine is 140,000 pounds, of which 122,600 rest on the drivers. The cylinders are 20 x 26 inches, and the drivers 56 inches diameter outside tires. The boiler provides 1909.1 square feet of heating surface and carries a working steam pressure of 180 pounds. The grate area is 80 square feet. According to the figures quoted it will be found that the tractive power is a little over 28,000, the ratio of adhesion 4.3 and the co-efficient of adhesion 0.256.

The driving wheel base is 15 feet 4 inches and the total wheel base 22 feet 6 inches. The main rod is 130½ inches from center to center. At its smallest part the boiler is 61 inches diameter. The firebox is 10 x 8 feet and provides 173.4 square feet of heating surface. There are 255 tubes in the boiler 2 inches diameter. It is covered with magnesia sectional lagging. Steel centers are used for all the driving wheels. The main journals are 8 x 10 inches, the weight per square inch carried being about 190 pounds.

DICKSON CONSOLIDATION FOR DELAWARE & HUDSON.

There is a decided difference of opinion among mechanics concerning the relative merits of straight and taper fits for crank pins. The straight fit is certainly the easiest to make, but the taper fit has its good points when well made. In a taper fit the parts do not come in intimate contact until the pin is pushed home, while with a straight fit there may be fairly tight contact long before the operation of pushing home is finished. More skill is required to make a taper fit than a straight one, but in the hands of an expert machinist the taper fit will be the better job.

The Roundhouse as an Erecting Shop.

In a split or division of the locomotive and car departments, when from any cause it is found necessary for economic reasons to abandon a plant, there are buildings always left to be absorbed into the remaining system. There are numerous instances where this has occurred with beneficial results to all concerned, since it tends to relieve congestion and gives room badly needed to do work that could not possibly be turned out except at a loss for want of space to properly handle it.

We can recall in this connection a roundhouse left as a heritage to the car department of a prominent road, by reason of a change of terminal for a locomotive district, a new house having been put up at the new place to meet the changed conditions. This old roundhouse was accepted as an erecting shop under protests of the most acrid kind, showing how strongly environment and habit may temper or bias the average mind. To-day a dispossess notice would get a hotter reception than the original order to move in received, for the reason that the men have found the roundhouse to be an ideal place for erecting purposes and far superior to their old shop.

Another and more recent instance of the kind, but in this case the motive power department was interested, was that in which a nine-stall roundhouse was taken for an erecting shop, but without coercive measures accompanying the proposition. They needed it, and were glad to get it. On putting in some improvements, which embraced a drop pit taking in all nine tracks, and putting up a jib crane so as to serve two pits each, the arrangement as we saw it left very little room for improvement.

Offset Eccentric and Valve Rods.

There are some details of a modern locomotive that give a shock to the nerve centers of the mechanical observer. One of these, the bent eccentric rod, is an old offender, thought to be an actual necessity from the fact that the design of mogul and ten-wheel engines forced the adoption of it to the front in order to avoid the use of a short rod with its supposititious evils of an excessive valve lead. A trial of the bent rod has developed some weaknesses that overshadow those of the straight but short rod. The most serious of these shortcomings is the tendency to spring at each reversal of movement and thus distort the action of the valve. This trouble caused breakage to an extent greater than was generally known, and only ceased by the adoption of a section that enabled the rod to resist rupture, but while heavy enough for that purpose, was not rigid enough to resist the strains without deformation. In consequence of this tendency to bend under stress, the short rod is found to be preferable, since lead at running cut-off can be arranged to offset most of the bad effects, which are not so real as to cause any hesitancy in a choice between the two types of rods.

One other detail suffering from the same cause and having the same effect on the valve's action, is the bent or off-set valve rod, seen on some ten-wheel engines built within the year. In the case of these engines, however, the eccentric

rods are straight, so that the valve is affected in a lesser degree than would be the case if both the eccentric and valve rods were offset, or the former alone, since the offset of the valve rod is considerably less than in the former instance. The actual effect of these offset members has been noted by us while applying the indicator from time to time and from observations made on those occasions we were convinced that details controlling the distribution of steam in the cylinder should be constructed with a view to rigidity rather than flexibility.

Gages and Templates in the Railroad Shop.

Among the best benefits coming to shops in the wake of, and as a consequence of the piece-work system, is the perfecting of templates and gages by which the piece system has reached its perfection by their aid, for each seems to be dependent on the other for its measure of success. But in any event, the shop that encourages the special-device idea for doing work, is the one that does better work and at less cost than the one that has no standards of length, breadth and thickness except those transferred from the 2-foot rule for each separate operation performed.

The question of interchangeability of parts does not press for consideration in a discussion of these devices for use in a railroad shop, although that is as good a thing to cultivate in those shops as in a manufacturing concern, for obvious reasons. It is in their value as time-savers that reference is made here, and not alone the accuracy with which duplication of parts may be made. This point is best understood by the man that is constantly setting a tool to hights from a given base—say, the platen of a planer or a milling machine. It is perfectly plain to him that he will get within about a sixty-fourth of an inch if he sets his tool by a rule or scale, and if the work demands greater accuracy there is no recourse except the cut and try method—take a cut at the edge and see how near the mark the job comes.

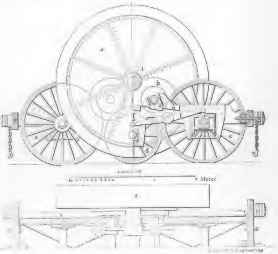
Depth gages have been thought by somebody to relieve this uncertainty. They serve the purpose, and do it so much better than any other way that it is a matter of surprise that they are not universally used. Such gages, made of round steel, about ½ inch in diameter, hardened and ground to length, and in a range of lengths from 1 to 12 inches high, by ½-inch graduations, are one of the best investments to be made for any shop. And why? Because a tool can be set to such a gage for depth of cut on a planer, borer or miller with absolute confidence in results. These gages may be made of cast iron if the refinement of hardening and grinding is thought too expensive; but a soft gage leaves an opening for the man suffering with abnormal muscular development, to mar and ultimately ruin it by always forcing the tool into it to make sure of a contact. This cannot occur with hardened gage, for the reason that the point of a tool will show the effect of forcing down, by a broken cutting edge after contact with the smooth, hard surface of the gage. One experience of the kind leaves a lasting impress on the strong man if he grinds his own tools.

On lathes the plug and ring gages occupy just as important a field as the hight gages, for the reason that they do away with those time-wasting trips to try the job of turning "and see how it fits." If a piston rod is the job in hand, the taper fits are simply turned to fit the ring gage, with the happy consciousness that the job will be a fit and have the proper amount of draw, knowing well that the other fellow is responsible for his manipulation of the plug belonging to that ring; that is, sizing the hole has been correctly done. The job is right, and neither man has been near the other with calipers or scale; and so with bolt fitting and every other job done in a lathe when gages are used. They cost money to make, but save money to use.

We recently visited a shop where gages were used on everything, namely, the P. C. C. & St. L., at Columbus, Ohio. The machinery department of this road under the jurisdiction of Superintendent of Motive Power Bush, has one of the best equipments of gages and templates in this country, comprising not only those touched on above, but many strictly new and original with that management, as well as those which long trial has demonstrated the utility of. A 10-foot steel scale, built on special order by the Browne & Sharp Company, is kept in the tool room as a reference instrument for the encouragement of accuracy. It is graduated to thirty-seconds, and as fine a piece of work as a mechanic would care to look at.

The Mahovos—A Russian What is It.

In looking over the very interesting report of Mr. Wm. S. Auchincloss on the Paris Exposition of 1867, we found a freak that may serve as a good example of how not to do it, for some of the modern power-savers. It is the invention of C. Schonberszky, of St. Petersburg, and was designed to be attached to a train; the momentum acquired on a down grade to be used to assist the locomotive up the next rise.



A RUSSIAN MOMENTUM ENGINE.

There were two flywheels *a* running on rollers *b*, which run on the wheel *d*; this in turn running on the track. The flywheel can be raised or lowered as desired.

In practice, the inventor intended making the flywheels weigh 12 tons each, and estimated that it would develop 500 horsepower at 500 revolutions per minute.

Needless to say, there is no record that they were ever used in actual practice, and the scheme evidently "died a-bornin'," as it should.

A new company has been formed by Mr. Quincy of the Q & C, and Mr. Wegges, president of the Railroad Supply Company, to handle their tie plate alone. The demand for their excellent tie plate is keeping the factories very busy.

The Dummy Coupling.

An extended tramp through railroad yards is one of the things likely to broaden a fellow's views about some things connected with details of rolling stock; granted, of course, that good use is made of the chance to take in and arrange for future use, the difference in practice governing matters supposed to be regulated by well-defined standards. A case in point is the dummy coupling hook. This is one of the best abused good things to be found on a car, a detail all right in itself, and when put up as it should be, fills the place it was designed for most admirably. The trouble with the dummy coupling hook is not resident in the hook itself, but it is always in the way it is applied. It does not follow that because the hook is hung so as to meet the requirements of recommended practice, that it will perform its functions properly on every car. There may be details of construction that prevent the location of it exactly where it should be, and then the time is at hand when a normal mental equipment is the only safeguard against a kinked hose.

The most cursory examination of cars at any transfer point will show the utterest disregard for the life of hose in this particular of kinking, and is certainly a lesson against a strict adherence to what may be good practice for some cases and execrably bad in others. The moral to be drawn is simply to put up the dummy so that it will act as it was intended to do, and let the other fellow's practice stand as good for that individual instance, provided it fails to fit your own wants. Whenever this course has been followed all kicks against the coupling have vanished at once.

We have happened on two such original applications of the coupling recently while prowling through the wastes of the West and South. One of these, on the Great Northern, had the coupling on the back end of tender riveted to a piece of flat iron, ⅜ x 2 inches, the iron being bolted to under side of sill with the flat in a horizontal plane, and at such an angle as to give the hose a very long bend. Placing the iron with the edges front and back made the connection rigid enough to prevent vibration and yet left the hose without an initial strain.

The scheme on the pilots of the Baltimore & Ohio is equally good. They cut loose entirely from the idea of bending the hose, and carry it down straight to the dummy couplings, which are blocked up high enough to meet the hose, and the latter lie on the slats of the pilot at full length—no kinks, no movement in either instance. It was certainly most convincing to us that there was no necessity for a hostile attitude toward the dummy, such as has been plainly shown. All it wants is to be properly applied and then let alone. There is no reason why it can't be put up right on a car as well as on a tender.

Novel Coaling Station.

A new and novel plan of coaling locomotives has recently been installed by the Pennsylvania Railroad at their roundhouse at Williamsport, Pa. An elevator has been constructed, which is operated by air supplied by two air pumps attached to a boiler about 30 feet from the structure. An air reservoir is situated near the elevator and is charged with compressed air to a pressure of 125 pounds. About 30 feet from the elevator an elevated railroad has been built upon which the coal cars are run and dumped into small cars underneath the tracks, each capable of holding several tons. When loaded, the small cars are run on a track to the elevator several feet from the docks, and hoisted by the air system to the necessary distance and dumped into the tenders of the engines. The cars are then lowered and run back to the wharf, where they are again loaded while others are being run on the elevator, hoisted to the top and unloaded.

NOVEL COALING STATION.

The Adoption of a Standard Knuckle.

The above is the title of a paper read before the Western Railway Club by Mr. Peter H. Peck, master mechanic of the Chicago & Western Indiana & Belt Railway. It deals in a very interesting way with the knuckle question, and incidentally throws some light on the situation that is understood only vaguely, if at all, by a good many engaged in car interchange. The table of different couplers in use is worthy of preservation. Below is the paper in full:

THE ADOPTION OF A STANDARD KNUCKLE.

"I will give the Club facts and figures, gathered by close observation during the past seven years in heavy interchange of cars, to show why a standard knuckle should be adopted by the M. C. B. Association. If it were not for the interchange of cars by railroads, Inter-State Commerce Commissions and M. C. B. rules or standards would not be necessary. The more cars interchanged the more standards are required in order that the cost of repairs may be kept at a minimum, and switching and delay to traffic avoided. If the railroads handled only their own cars, standards common to several roads would not be necessary any more than for street cars, wagons or any other class of vehicle. I recollect my first days of railroading—on a road west of the Mississippi river; we had no connection with any other road. Freight was ferried across the river or arrived in steamboats and was transferred to our own cars. The first road with which a connection was effected was the B. & M. at Ottumwa, Iowa, after which time we hauled some foreign cars but for a short distance only. Cars varied in hight so much that every locomotive and way car was furnished with three-pocket drawheads, in order that our trains could be coupled up. Since that time railroads have extended their lines into almost every town of note, bridged all of our large rivers and connected their tracks at terminals in order that an interchange of cars might be possible. As the volume of interchange increased, new difficulties and dangers arose, viz.: Competition, faster time, larger locomotives and cars, and long hauls without breaking bulk. The M. C. B. Association was organized to devise means for overcoming these difficulties and dangers and the annoyances occasioned thereby, and to-day all the leading roads and private car lines are members of the Association, representing an aggregate of over one million cars. Rules governing the interchange were framed and standards adopted, and the adoption by the Association was followed by legislation on the part of both the State and national governments to compel the use of the standards.

"We have standards for many parts of trucks, and standard drawbars, but the latter ends at the contour lines, leaving the most essential feature, the knuckle, not standard. The knuckle receives the shock first, and is therefore most likely to be injured; and for this reason, if for no other, it should be interchangeable. Delays of several hours are frequently caused by having to set a car on the repair track to change the bar, because there may be no knuckle at hand which will fit the coupler head. With the link and pin bar such delays would not occur.

"During the last few months I have endeavored to secure the names of the different knuckles in use at the present time and the numbers of different designs furnished by each coupler company. The result was much of a surprise to me; the number is still on the increase, as can readily be seen by referring to the list of patents issued each month. The following statement represents the result of my efforts in the direction referred to:

KINDS OF M. C. B. COUPLERS AND KNUCKLES IN USE.

Weight of Knuckle.	Name of Coupler.	Number of Knuckles.	Weight of Knuckle.	Name of Coupler.	Number of Knuckles.
46 lbs.	American	2	50 lbs.	Lone Star	1
	Ajax	1	50 "	Little Delaware	1
49 "	Barfield	1	49 "	Mo. Pacific	2
	Barnes	1	37 "	Mather	1
	Brown	1	48 "	Murphy	1
54 "	Burns	1		Marks	1
46 "	Buckeye	3	53 "	New York	1
	Cowell	1	43 "	National	1
48 "	Columbia	1		Price	1
51 "	Chicago	2	38 "	Pooley	1
35 "	California	1	49 "	Perfected	1
40 "	Champion	1		Paragon	1
	Deetz	1	39 "	Peerless	1
64 "	Dowling	2		Pacific	1
57 "	"			Rickson	1
60 "	Drexel	2	55 "	Standard	1
45 "	Detroit	1	49½ "	Solid	1
43 "	Diamond	1		Shomaker	1
52 "	Excelsior	1		Santos	1
	Edwards	1		Springer	1
36 "	Empire	1		Simplex	1
42 "	Eureka	1	54 "	St. Louis	2
51 "	Erie	1	47 "	Smith	1
41 "	Elliott	1	66 "	Standard Improved	1
	Foster	1	53 "	Smillie	2
49 "	Forsyth	1	51 "	S. H. & H.	1
	Fox	1	51 "	Safety	1
38 "	Gould	1	50 "	Talbot	1
38 "	Gallager	1	50 "	Trojan	1
	Gifford	1	53 "	Tower	2
	Gelston	1	50 "	Thurmond	2
51 "	Hanson	2	46 "	Taylor	1
41 "	"			Timms	1
38 "	Hien	2		Union	1
	Imperial	1	50 "	Vandorson	1
40 "	Interstate	1	34 "	Williams	3
3. "	Janney	1	40 "	"	
37 "	Johnson	1	45 "	"	
	Kling	1		Walker	1
	Laburt	1	50 "	Washburn	1
61 "	Ludlow	1			

"A total of 77 bars and 83 knuckles; nine bars having two, and two bars having three knuckles each, and in only one instance will the knuckles interchange with each other. The average weight of the 56 knuckles, the weight of which is known, is 48 pounds; the heaviest being the Standard, 66 pounds; the lightest the Williams, 34 pounds.

"In order to have, in way cars or at interchange points, knuckles (one of each kind) averaging 48 pounds, it would require 4,464 pounds, which, at 3½ cents per pound, would cost $156.24. To furnish one knuckle of each of the above kinds at sixteen different points and for twenty way cars, it would require 160,704 pounds, representing a value of $5,624.64.

"I find, from the records kept in my office for the past six and one-half years, that as the number of M. C. B. bars handled increased, the percentage of broken bars and of broken knuckles decreased, as shown by the following table:

Year.	Per Cent. M. C. B. Bars.	No. Cars to One Bar Broken.	No. Cars to Knuckles Broken.
1892	8 per cent.	377	2,476
1893	15 per cent.	385	1,684
1894	20 per cent.	424	1,609
1895	28 per cent.	620	1,663
1896	42 per cent.	990	2,345
1897	48 per cent.	1,240	2,573
1898	59 per cent.	1,872	3,047

"A large proportion of the breakage of knuckles occurs when a M. C. B. coupler is coupled with a link and pin bar, such breakages being most likely to occur in heavy trains. In some cases the coupling is made by the pin being placed through only the top hole of the knuckle and into the link; this either breaks the top lug off or breaks out the pin hole; in other cases the knuckles may be broken when two cars strike together and both knuckles are closed. Very few M. C. B. bars are broken when two of these bars are coupled together. Included in our own equipment we have 88 cars and 22 locomotives equipped with M. C. B. couplers; 32 cars equipped last year and the locomotives equipped within the last eight months. As yet we have had but one knuckle broken (that on a car) and that was caused by an accident. One of the engines equipped in this manner is double-crewed most of the time for service both night and day. This serves to illustrate the fact that the proportion of breakage to M. C. B. couplers on switching roads is much less than many believe to be the case.

"I do not find, in actual practice, the trouble anticipated by Mr. P. Leeds, in his paper before the Central Association of Railroad Officers, as published in the *Railroad Gazette* August 12, 1898, viz.: Flange wear or crowding the flanges against the rail, or that the bar is not strong enough for our modern 80,000 and 90,000-pound capacity cars. We handle hundreds of these cars and the number of breakages of couplers is no greater than with other cars. We do find, however, that when these heavy cars strike very hard the load shifts, in some instances forcing the end out of the car, but not breaking the bar. I have seen cases of rear end collisions and trains breaking in two, and have found that in such accidents the damage to M. C. B. bars was not one-fourth as great as that to link and pin bars. Cars are not as liable to telescope when equipped with M. C. B. couplers as when equipped with link and pin drawbars.

"In regard to the handling of passenger equipment, we have five roads for whom we do the switching at Dearborn station, four of which use the M. C. B. bars, the fifth the Miller hook bar. It is possible to couple the M. C. B. couplers on short curves where the same is impossible with the Miller hooks. We have two engines equipped with the M. C. B. couplers in this service, and we are able to couple the engine to M. C. B. bars at points where it is impossible to couple the Miller, with link and pin.

"Finally, the trucks, draft rigging, drawbar stops, uncoupling levers and knuckle should be standard and interchangeable. The knuckle, most important of all, should receive immediate attention by the M. C. B. Association, and either the patent rights of a knuckle should be purchased by the association, or six or seven of the best knuckles at present on the market should be adopted as standard; there are at least six or seven which are first class. If something like this is not done before the law goes into effect we will soon be in a worse sea of trouble in interchanging cars than we were in with the link and pin. A cored or hollow knuckle should not be considered; such knuckles are of no value whatever. It is only fourteen months to the time the law takes effect, and something along the lines indicated in the foregoing should be done without delay."

We learn from a Denver paper that the Denver & Rio Grande road over the La Veta pass will be broad gaged at once and the great San Luis valley will have an outlet to the world that will not necessitate the transferring of freight from broad to narrow gage cars. Besides, the distance as well as the grades from Alamosa to the main line of the Rio Grande will be very much better and the cost of operation correspondingly lightened.

A suit was brought by John Hendley against the Louisville & Nashville Railroad for damages on account of being prevented from obtaining employment through being blacklisted. The plaintiff lost the case for want of sufficient evidence to prove that he had been blacklisted, but the court held that had the claim been proved the plaintiff would have been entitled to damages.

EQUIPMENT NOTES—*Continued.*

The Wells & French Car Company have ten freight cars under way for the Duluth, South Shore & Atlantic.

The Baldwin Locomotive Works are building two six-wheel connected engines for the United States Government.

Two engines are being built for the Kansas City Suburban Belt Railway at the Baldwin Locomotive Works.

The Western Equipment & Car Company have ordered twenty-five cars from the Illinois Car & Equipment Company.

The Baldwin Locomotive Works are building two six-wheel connected engines for the Oahu Railway & Land Company.

Two consolidation engines are being built for the Pittsburgh, Bessemer & Lake Erie at the Pittsburgh Locomotive Works.

The Southern Pacific are having twenty-nine engines built at Schenectady; —three eight-wheelers and twenty-six ten-wheelers.

An order for 5,000 freight cars for the New York Central has been divided among the Union Car Works, Buffalo Car Works, and Pullman's.

The Wisconsin Central Lines are to have 250 freight cars from the Pullman Palace Car Company, and 100 from the Ohio Falls Company.

The Midland Railway of England have ordered twenty engines, ten from the Baldwin Locomotive Works and ten from the Schenectady Locomotive Works.

The Pittsburgh, Bessemer & Lake Erie have an order with the Schoen Pressed Steel Company for 200 freight cars. The Schoens are also building 100 cars for the Union Railroad.

The Illinois Car & Equipment Company are engaged on an order for 600 cars for the Chicago, Burlington & Quincy, and a like order is under way for the same road at the Wells & French Works.

The Pennsylvania Company have ordered 500 cars from the Schoen Pressed Steel Company, 300 from the Erie Car Works, 300 from Wells & French Company, and 100 from the Illinois Car & Equipment Company.

The Southern Pacific has found it necessary to increase its rolling equipment to the extent of about two million dollars. This immense order embraces fifty engines, most of which will be freight ten-wheelers, and 3,000 cars, of which 2,500 will be box, 250 flat, and 250 gondolas.

The Pennsylvania Railroad Company has apportioned an order for cars as follows: twenty passenger and 400 freight with the Pullman Company; 400, Missouri Car & Foundry Company; 400, Michigan Peninsular Company; 150 Murray Dougal; 400, Terre Haute; 150, Allison; 100, Lebanon.

The Baldwin Locomotive Works have recently closed with the Imperial Railway of China for the construction of sixteen engines, which makes the second order from China in the past ten months. Besides this order, these works have also closed contracts to build forty engines for other roads. These orders, together with work on hand, make it necessary to work the plant night and day and also increase the force to over 5,000 men, an unusual thing at this time of year when men are generally laid off.

We notice from the record of patents granted that the link and pin coupler is still the object of rustic inventors. These people seem to be very fond of contributing to the receipts of the U. S. patent office.

The Hilles & Jones Company, Wilmington, Del., have issued a very handsome illustrated catalog showing a few of their representative machines for working plates, sheets, bars and structural shapes. Descriptions, photographs, weights and prices will be cheerfully furnished on application.

One of the most attractive reminders of the holiday times that has come to this office, was a beautiful box of pencils and erasers, sent by the Joseph Dixon Crucible Company, Jersey City. It came in good time, too, for the few remaining from last year's gift were burned out with the rest of our office things. Joseph Dixon Crucible Company, may you live long and prosper. We have no conscientious scruples about accepting presents.

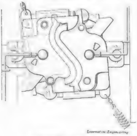
"American Schools of Mechanical Technology" is the name of a very handsome book of 142 pages, published by the Buffalo Forge Company, Buffalo, N. Y. It contains beautiful half-tone engravings of a great many technical schools and views of the interiors of blacksmith shops, foundries and other places where forges and the varied appliances made by the publishers are used for equipment. Besides the attractive pictures, the book contains valuable information about forges and methods of keeping shops free from smoke and gas. Every foreman blacksmith ought to have the book, and it will be helpful to all men in charge of machine shops and foundries. We were surprised in going through this book at the great number of schools of Mechanical Technology that are mentioned. We learn from the company that the book does not mention nearly all the institutions whose shops have been fitted out with the Buffalo Forge equipment.

Safety hollow staybolts, made by the Falls Hollow Staybolt Company, have been specified for the locomotives being built for the International & Great Northern Railroad by the Rogers Locomotive Company.

A Curious Patent.

The engraving shown below is taken from the *Patent Office Gazette*. When we looked at it the thing struck us as one of the most extraordinary inventions ever produced for the purpose in view. Thinking it would puzzle the ordinary run of railroad men to tell what the device was we covered the description and called in our office force to guess on what it was. One said it was some sort of a valve motion, another guessed that it was an intercepting valve mechanism, while a third man, who was brought up in the country guessed it was part of a threshing machine.

In looking at a complex piece of mechanism in an engraving, or even in a model, it is never safe to jump at conclusions without giving the thing exhaustive study. The writer once got into an embarrassing position when consulted as an expert by jumping at conclusions about the purpose of an apparatus. It was at the time when the inventing of car couplers was epidemic. A rustic looking gentleman with the usual black waterproof bag walked into our office and remarked that he had a little invention that he wished to have examined, and he had



WONDERFUL INVENTION.

come on the recommendation of a well-known master mechanic. We told him to get it out and put it together on the floor. This was done, and after gazing at the apparatus sadly for a few minutes, trying to understand in what way it would hold cars together, we remarked: "Friend, you have succeeded in one thing. You have made the most extraordinary car coupler we have ever seen."

The old gentleman looked in a startled sort of way at his invention, and said: "That was not intended for a car coupler; that's a potato digger!"

As soon as we recovered from the emotion the mistake excited, we told him to put back his invention into the bag, as we did not profess ourselves competent to give advice on the value of agricultural implements.

The cut shown is not a potato digger. It is intended as a car coupler, and is so described in the *Patent Office Gazette*. The inventor is William C. Shaw, White Plains, Ind.

Prince of Wales' Car.

The private car of the Prince of Wales was designed by James Holden, the carriage and wagon superintendent of the Great Eastern Railway, says the *Railway Car Journal*. As a private car it differs very materially from those to which we are accustomed in this country, and shows a marked variation in the habits of the users. This car, to begin with, is only 41 feet long, a length into which it would be impossible to compress the requirements of a private car adapted to American travel. Its internal arrangements show that it is especially intended for short journeys, and for that reason it is not fitted with kitchen, dining room or sleeping accommodations. On the other hand, the very fact that it is intended exclusively for day travel enabled the designer to divide it into larger compartments than usually obtain, even in our larger cars, where a wider variety of service must be provided for.

The floor plan is divided into four compartments, with a side passage running along one side of the car to connect the main salon with the servants' compartment. This main salon is very large, being 17 feet 6 inches long and the full width of the car, and is separated by a lobby from the lavatory. It is in the location of this main salon that we notice a decided departure from the practice that an American designer would probably have followed. With us the observational features of the main salon are the great attraction, and we would have put the room at the end of the car and filled the same with large windows, so as to afford a clear view down the track. But English practice does not put windows in the ends of its cars, nor, we believe, is it in the habit of putting first-class carriages on at the rear; so that the prince misses what we look upon as the best taste of railway travel.

The car is, however, fitted with all modern appliances. There are electric signals throughout; the lavatory has running water, the tanks being encased in the partitions on either side of the door. The furniture of the salon and smoking compartments is upholstered in royal blue morocco leather, while that of the servants' compartment is of dark blue buffalo hide, and in one corner there is a beaten copper bracket supporting a gas stove and a small kettle. The car is lighted by compressed oil gas burned in seven lamps with duplex burners.

The paneling of the royal compartments is of well-figured satin wood molded with walnut, plain walnut being used for the servants' compartment. The ceiling is covered throughout with cream-colored Lincrusta Walton picked out in gold, and covering all of the car lines. The metal fittings in the salon lavatory, lobby and smoking-room are of burnished silver; burnished brass being used in the servants' room. The large windows of

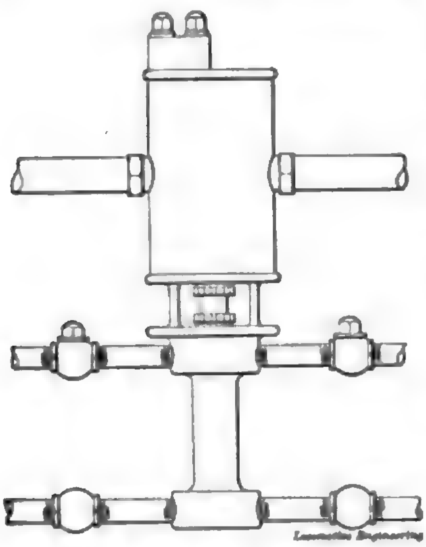
the main salon are provided with silk hanging curtains to match the leather of the upholstery, and the small windows throughout the car are fitted with patent blinds of the same color.

The upper framing of the car is of oak and teak, with outside paneling of the best teak. The body is varnished and picked out in gold. The monitor roof which we consider to be one of the essentials of a comfortable car is lacking, and the clear hight of the roof is not more than 7 feet 7 inches on the inside of the car at the center.

The car is an interesting example of designing, in that it shows what ample facilities can be provided within very narrow limits for comfortable travel by day, where all of the appurtenances belonging to the long journeys of this country are not in demand.

Pump for Boiler Washing.

The pump illustrated herewith is the design of Master Mechanic Lloyd, of the Chesapeake & Ohio shops at Richmond, Va. It was made to wash out boilers, and



WASHING OUT PUMP.

a 6-inch air-pump cylinder was the base on which the pump was built, by removing the air cylinder and substituting therefor a pump having a 1¾-inch plunger, the latter being simply an extension of the 6-inch piston rod. The pump is piped to so as to lead to each pit in the shops, and is therefore available to any point where needed. It is located in the shop engine room, with the fire pumps, and while not properly a part of that system, can be used as an auxiliary to wet things down in emergent cases. As will be seen, there is nothing to it except the pump barrel and four check valves to govern the admission and discharge, which makes a very inexpensive thing to build when there are old 6-inch air pumps to be had.

Against Grade Crossing.

In the last biennial report, the Illinois Railroad & Warehouse Commission took very strong grounds in favor of legislation which would largely increase the powers of the board in several particulars. The recommendations were very badly received by the Illinois press, but we cannot see wherein the recommendations have been in any way at fault. The principal question calling for increased power is that in relation to the crossing of railways by highways at grade. The statement was made that during the last year 213 persons were killed and injured at crossings of this kind—a condition of affairs that certainly demands some kind of remedy. One part of the report says:

"The constant construction of new street railways in the large cities of the State, and the consequent crossing of steam railroads at will by the street railways, is a menace to life, and many of the accidents this year have been the result of collisions at these crossings. This surely demands some legislation. We hold that this commission has, under the law, a right to control these crossings, but it is questioned by some able authorities, and we therefore recommend that a law be passed placing the street railways under the jurisdiction of the commission, and that this commission be empowered to order interlocking systems at such existing crossings as they may deem necessary, and be given full authority to specify the place, manner and mode of crossing of all street railways that shall be built in the future."

There appears to be a strong opposition at present in the State of Illinois to give increased power to boards, or, in fact, to any constituted authority; but the need for improvement in the practice of permitting electric roads to cross steam railways at grade is so urgent that we think the common sense of the community will come to support the sensible recommendations made by the men referred to.

Framing of Cars—Western Railway Club.

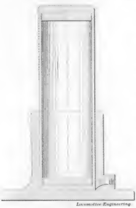
At the November meeting of the Western Railway Club a paper on "The Framing of Cars" was read by Mr. F. M. Whyte, showing the effect of truss rod location on body bolsters of cars. The reasons for better attention to bolster design were very clear and convincing, and directly confirming what was said on the subject in these columns in our issue of November, 1897. There is no room for question about the advantages of locating the truss rods as near the center of the car as will give the least bending moment at the center of bolster, assuming, of course, that proper care is taken to preserve the strength of other details of the framing affected by such a change in position of the rods.

In the design of body bolsters there are unknown quantities to cope with just as in many other mechanical details, and the one that the designer cannot provide for intelligently in this case is a concentrated end load. It is not difficult to see that a bolster so loaded is in the best condition for deflection, since its strength is calculated generally for a distributed load in order to keep down dead weight.

That portion of the paper referring to the wooden framing contains some valuable hints about distribution of material in upper and lower framing, and the effect of a weak member on the body as a whole. In the discussion of the paper by the members there was considerable information brought out that will pay a man who is interested in the technics of car framing to have for present reference, since all of those participating knew what they were talking about.

An Air Ram.

The "cannon" has become a familiar tool for starting an obstinate bolt, and has been found very useful for the purpose;



Locomotive Engineering

Air Ram

but there is more or less danger attending the manipulation of a tool which depends on an explosive for its energy. We illustrate an air ram which was gotten up by Master Mechanic New, at the Missouri Pacific shops, Kansas City, Kansas. This tool is intended to do what the cannon was made for—that is, drive out cylinder and frame bolts—and it does the job very nicely by means of compressed air.

A piece of gas pipe plugged at the ends and fitted loosely in a cast-iron base is all there is to the ram. A ½-inch pipe is tapped into the base to receive the air, and a ½-inch plug cock controls the admission of air. It strikes a savage blow and is perfectly safe to use. There is no packing about the affair. The pipe is 1-32 inch less in diameter than the base, which does not affect the results, as the ram does its work by impact and not pressure. A quick opening of the cock to admit air is what sends the ram up, and gravity carries it down when the air is exhausted.

Palatial Cars on the Lehigh Valley.

The new cars Spartan, Trojan, Grecian and Corinthian, recently placed in service on the Lehigh Valley, between Buffalo and New York, are the latest production from the Pullman Works, and they are considered superior to any heretofore constructed. Several special features have been introduced which will undoubtedly make them popular with the traveling public, the most important of which is the commodious ladies' boudoir, which is provided with a dresser. The cars are 78 feet long over platforms, and contain all the latest improvements, including wide vestibules, Pintsch gas system of lighting, and safety system steam heat. They are finished in carefully selected vermilion wood, secured in the East Indies, and are plainly yet handsomely decorated with the latest design inlaid marquetry work. The upholstery on the seats and backs, which is a moquette of a Persian design, with green border and center pattern of bright colors, was specially imported for these cars. The ornamentation of the ceiling harmonizes with the upholstery and other interior finishings, giving the car an Arabesque effect. The carpets are of a rich velvet, and passengers entering the cars at once note the elegance and at the same time the simplicity of the ornamentation of the finishings, which give them a delicate appearance, difficult to describe, and which must be seen to be appreciated.

Weight of Engine Belongs to Weight of Train.

There were some curious remarks concerning weight of trains made in a London publication lately by a party posing as an authority on train speeds. He says: "In this connection, I venture to enter my protest against the inaccurate and unscientific practice so prevalent of quoting the weight of engine and tender as the weight of the engine, and of reckoning the weight of the engine and tender as part of the load hauled. In the former case the absurdity is manifest when it is remembered that the weights of British express tenders vary from 25 to 45 tons, and that some of the lightest tenders are used with some of the heaviest engines, owing to the water trough and pick-up scoop being employed. Thus a London & North Western engine of the Greater Britain class, which weighs 52 tons, having a tender of only 25 tons, is made to appear smaller than another engine weighing only 39 tons which has a 40 ton tender. And the error of including the weight of engine and tender in that of a train hauled is

manifest when it is recollected that the weight on the driving or coupled wheels—that is to say, the adhesion weight—is not hauled, but itself hauls the engine. If this be doubted, the fact can easily be proved by trying an engine with the driving wheels raised from the rails. I suspect that the progress made would be small. And the rest of the weight of the engine and tender is virtually part of the apparatus used for hauling, and not part of the load hauled. I deal with these inaccuracies because they are so confusing and hampering when any comparison of work is attempted. The performance of an engine with a 200-ton train may seem highly creditable until it is noticed that the engine and tender weighed 90 tons of this, leaving only 110 tons as the load really hauled."

It is hardly worth while taking notice of silly stuff of that character, which is evidently written by an amateur engineer trying to discuss a problem that was beyond the scope of his mental grasp, but it may mislead some people. You certainly cannot make a *scientific* estimate of the work a locomotive is doing unless the whole of the weight moved is taken into account. The fact that tenders differ so much in weight makes it the more important that the weight of engine and tender should be included in the train tons. The weight of engine is certainly included in all formulæ for calculating the power of locomotives.

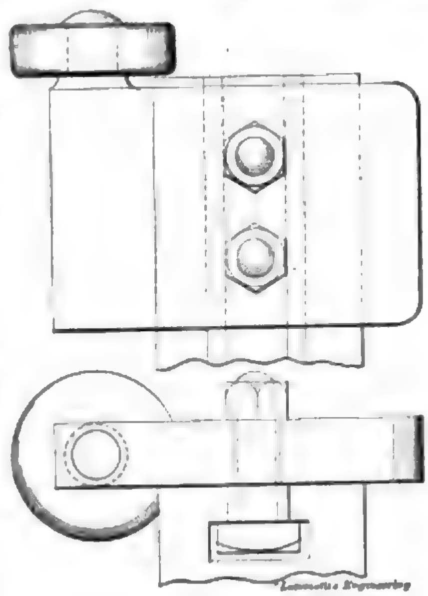
Through some mental twist, the writer of the words quoted would like to calculate the work done by a locomotive the same way as would be correct if it were acting as a stationary engine. If the suggestion to raise the driving wheels from the rails were followed, and means taken to transmit the power developed by a dynamo or other medium, the weight of the locomotive would then cut no figure. But as long as it has to move itself as well as the train, the weight of locomotive and tender must be taken into consideration.

Changes on the Nashville, Chattanooga & St. Louis.

The office of general superintendent of the Nashville, Chattanooga & St. Louis has been abolished, and Mr. M. J. C. Wrenne, who has held that position, has been appointed superintendent of transportation, with jurisdiction over the entire system. The road will be divided into five divisions, each to have a division superintendent. The first division, comprising the line from Hickman, Ky., to Nashville, Tenn., from Dixon to Mannie, and the West Nashville line, and the second division embracing the line from Nashville to Chattanooga, including the Lebanon branch, and the branch lines from Watrace, Cowan and Bridgeport, will be in charge of Mr. J. H. Peebles as division superintendent, with headquarters at Nashville, Tenn. The third division, known as the Atlanta division, will be in charge of Mr. J. L. McCollum, as division superintendent, with headquarters at Atlanta, Ga. He has been superintendent of the Western & Atlantic. The fourth division known as the Paducah division, will be under charge of Mr. W. J. Hills, as division superintendent, with headquarters at Paducah, Ky. The fifth division, known as the Huntsville division, will be in charge of Mr. G. D. Hicks, with headquarters at Tullahoma, Tenn., as heretofore.—*Railway Age.*

Roller for Driving Axle Journals.

One of the strange things one encounters when in strange shops is the unmechanical filing of axle journals. There seems to be an unreasonable and blind antipathy to any other process of finishing a steel journal (and an iron one, too, if it is one of the seamy kind), and a peculiarity of this thing is that the opposition sometimes comes from mechanics who have lucid intervals on every subject but this. There is no question about the superior surface left on a journal by the roller, if it is properly used. The requirements of a truly cylindrical and smooth journal are fulfilled better by the roller than by the cutting tool even, and to put a file on such a surface as a journal is simply vandalism; but it is done every day.



ROLLER FOR DRIVING AXLE JOURNALS.

To make good a promise given while over in the West recently, we illustrate a roller for driving axle journals. It is reversible, and can, of course, be used on any job where it is necessary to get into a corner. This roller was designed by A. G. Elvin, general foreman for Master Mechanic A. T. Stewart, of the Chesapeake & Ohio, at Huntington, W. Va. Mr. Stewart has everything rolled that requires a true smooth surface, and this includes all axle journals, crank pins, pis-

ton rods, and valve stems. A water finish or file on round work has no place in that shop, and they disappear in every other one where the roller is given a chance without prejudice to buck against. We have taken pleasure in disseminating the facts about this tool, and to those who from apathy or any other reason have not used it, we say give it a trial; it's a good thing, and once used becomes a permanent fixture.

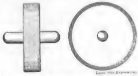
The annual report of the Nebraska State Board of Transportation, which has just been issued, contains an interesting chapter on the subject of giving and accepting railroad passes. A list of State officials who hold passes is given, and includes every officeholder and prominent politician in the State. The reasons for giving passes are thus interpreted by the board: "Some passes are granted for the same reason that an unarmed citizen surrenders his purse in the night—for peace and safety. There are highwaymen who hold up corporations, candidates for office and evil-doers, who pay to avoid exposure. Such men sometimes become members of legislatures. Passes are granted these men, not for the good they do, but to keep them from doing harm." The passage of a law prohibiting railroads from giving passes to State officials and the latter from accepting passes is recommended.—*Railway Age.*

The reports of the Interstate Commerce Commission show that the amount of money paid in dividends by the railways in a year is from $57,000,000 to $58,000,000, the amount paid in salaries to all officials is about $12,000,000, while the amount paid to labor is over $460,000,000. The hard times following the panic of 1893 reduced the gross earnings of the railways by over $1,100 a mile. That would mean over $200,000,000 for the 185,000 miles of railway in the country. The result was that the railways were compelled to economize on labor. In 1893 there were 515 men employed to every 100 miles of line, and in 1897 only 459, which is to say that there were 66 fewer men to every 100 miles of road. If in 1897 there had been as many men to every mile of road as there were in 1893 the railways would have employed 122,000 more men than they did. This must always be the effect of any loss of earnings to the railway companies. The interest of labor is far greater than any other interest in the railways, and whatever hurts the railways hurts labor.

In another part of the paper we mention the fact that the Nashville, Chattanooga & St. Louis' management have determined to raise the pay of their employés. We now learn from the *Railway Age* that the Southern Railway will restore the 10 per cent. cut in wages of shop men made in 1893, and that the Louisville & Nashville will take similar action with all employés that suffered a reduction during the hard times. Another road's management, however, presents a contrast. An order has been issued by Superintendent Williams of the Omaha, Kansas City & Eastern, making a reduction of 10 per cent. in the salaries of all employés receiving $75 or over per month, except engine, train and yard men.

Wheel for Graining on Wood.

The grain effects obtained in a large part of passenger car work is no longer the result of the comb and chamois skin. These stand-bys of the artist have been replaced to a great extent on the commoner parts of a car by the wheel shown in our engraving. This wheel is made of wood, and is covered on its periphery with a composition the same as used on printer's rolls. The grain of any wood that is required to be reproduced is first brought to view by planing that particular piece of wood, after which the color is laid on, when the wheel with



WHEEL FOR GRAINING ON WOOD.

its soft composition is rolled over the painted surface of the grain to be copied, and takes it up with the pigments, as shown in the cut. The wheel is then transferred to the surface requiring the graining, and being rolled over same, deposits the color and leaves a faithful representation of the actual grain of the wood. This process is used on window sash and other parts of a car not requiring expensive hand work.

The French Minister of Public Works has issued a circular order to Prefects throughout the Republic calling attention to the fact that acts of malicious trespass on railroads are becoming more frequent. While these are often committed by children, who do not know the consequences, they are sometimes committed by people with malicious purpose, and some very serious accidents have resulted. The Minister calls for greater vigilance on the part of the officers of the railroad companies and of the local authorities. He asks that orders be issued to mayors of cities, to the police and to the gendarmes, to aid the railroad officers in carefully guarding against such acts. The most of those who commit these acts are never discovered.—*Railroad Gazette.*

PERSONAL.

(Continued.)

Mr. W. B. Bates has been appointed master mechanic of the shops of the St. Louis, Iron Mountain & Southern at Memphis, Tenn.

Mr. W. M. Paul has been appointed master mechanic of the Wabash shops at Tilton, Ill. in place of Mr. G. J. De Vilbiss, transferred to Peru, Ind.

Mr. T. A. Davies, formerly master mechanic of the Wyoming division of the Union Pacific at Cheyenne, Wyo., has been transferred to Ogden, Utah, where he will have charge of the shops.

Mr. H. C. Woumbledorf has been appointed foreman of car inspectors of the Texas & Pacific, with headquarters at Marshall, Tex. He was formerly car foreman of the St. Louis Southwestern at Tyler, Tex.

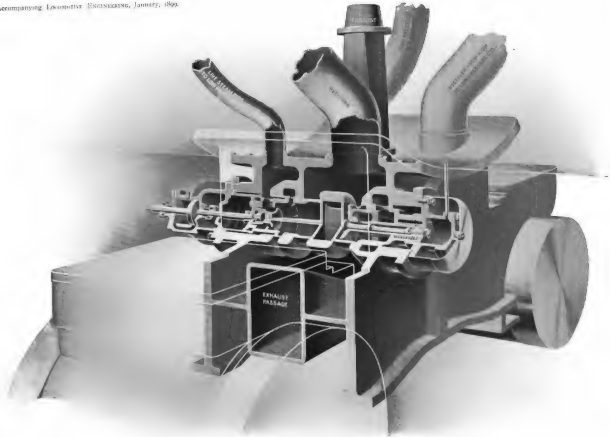
Mr. R. H. Bowen has been appointed superintendent of the Cascade division of the Great Northern, with headquarters at Everett, Wash.

Mr. Frank Shesgreen has been appointed superintendent of the Willmar division of the Great Northern, with headquarters at Willmar, Minn.

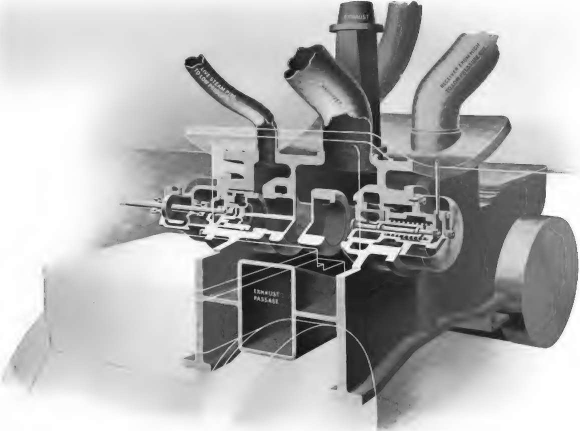
What we are missing very much in our new office is having no files of the back volumes of LOCOMOTIVE ENGINEERING. If our readers know of any set for sale, they would confer a favor on us by letting us know where they are to be had.

We understand that the management of the Texas & Pacific have voluntarily increased the wages of passenger conductors from $100 to $125 a month.

Accompanying Locomotive Engineering, January, 1899.



SCHENECTADY COMPOUND LOCOMOTIVE—INTERCEPTING VALVE IN SIMPLE POSITION.



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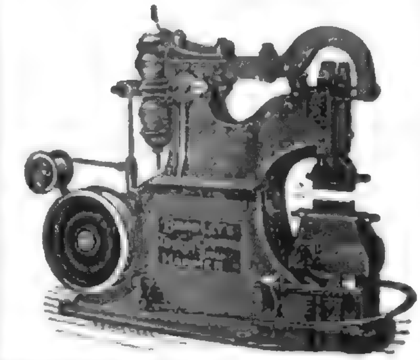

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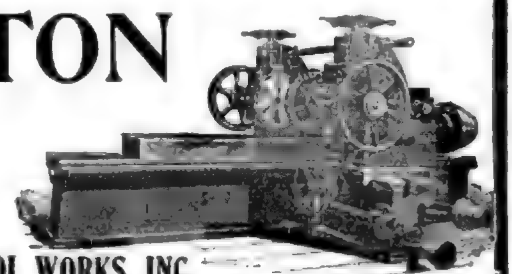

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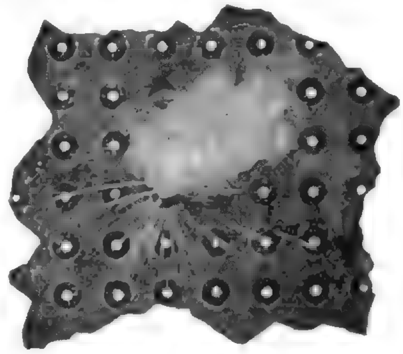

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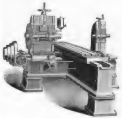

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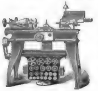

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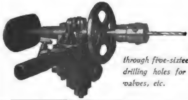

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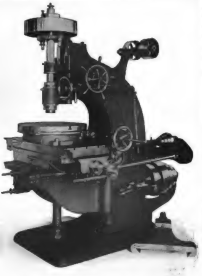

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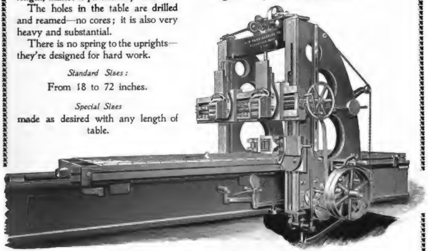

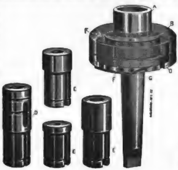

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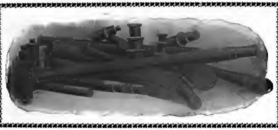

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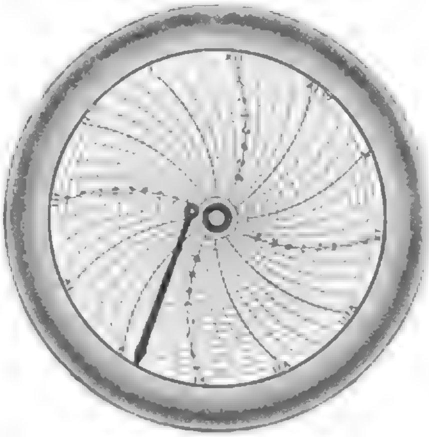
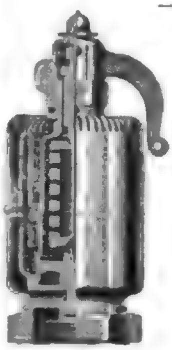


This recorder shows at a glance the pressure in train pipe and auxiliary reservoir, reduction for each application, how long brakes were applied, rise of pressure to release, uniformity of pressure, etc., etc. It will pay you to get better acquainted with this.



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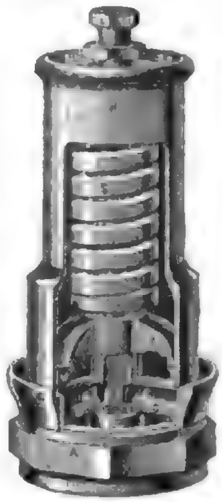

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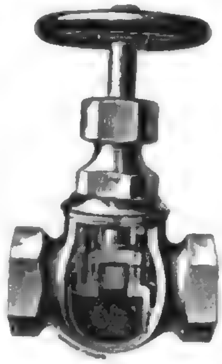

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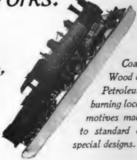

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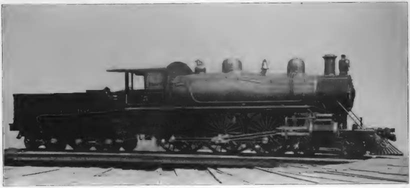

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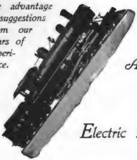

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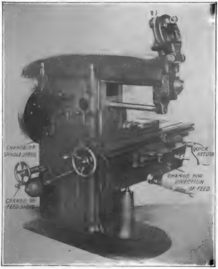

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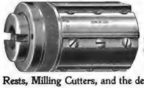

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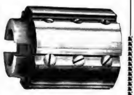

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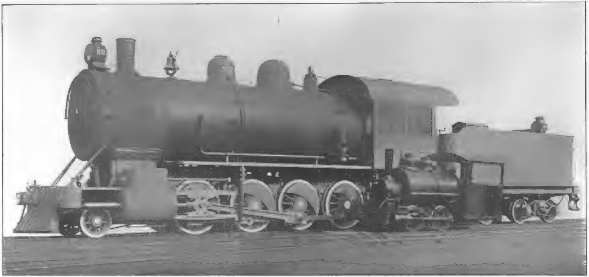

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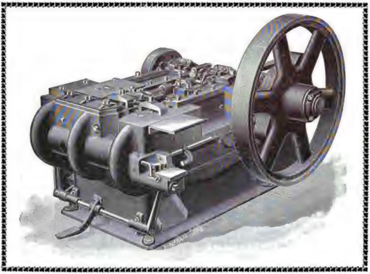

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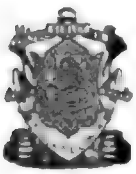

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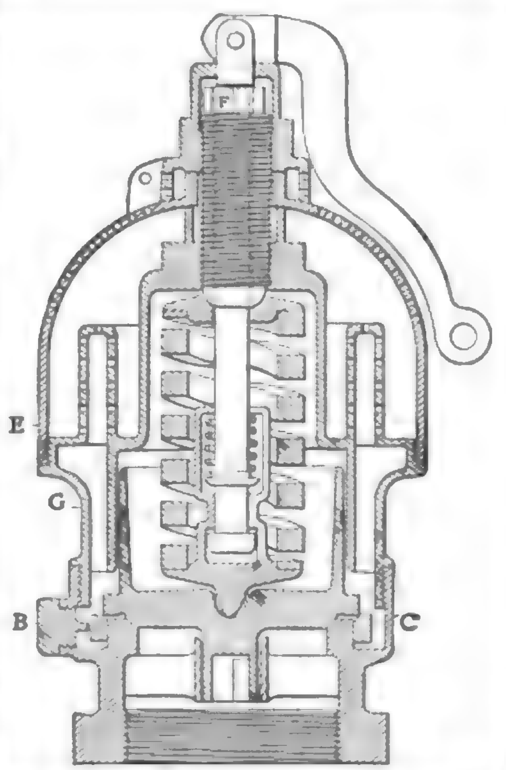

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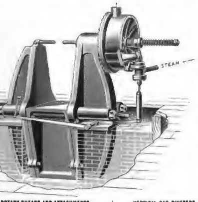

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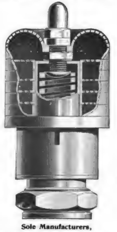

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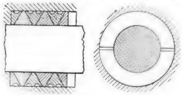

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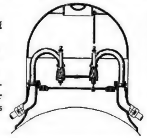

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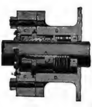


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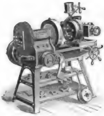

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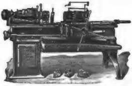

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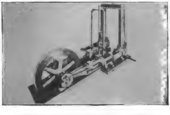

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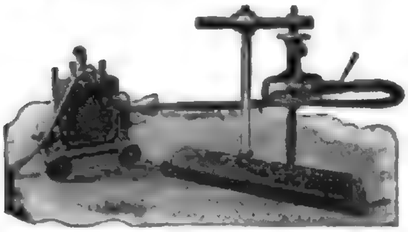

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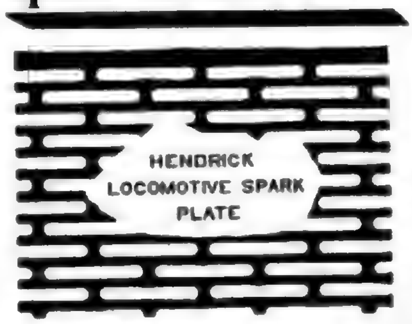

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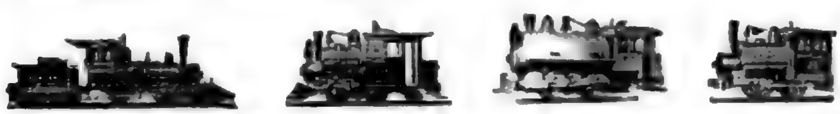

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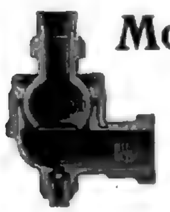

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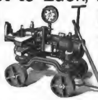

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Have You Seen Page 44?

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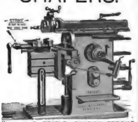

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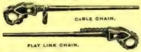

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LocomotiveEngineering

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XII | 95 Liberty Street, New York, February, 1899 | No. 2

Rogers Ten Wheeler for Mobile & Ohio.

The fine-looking ten-wheel engine hereby shown was recently built by the Rogers Locomotive Works for the Mobile & Ohio Railroad Company. The cylinders are 18 x 26 inches, and the diameter of drivers 62 inches. The weight of the engine in working order is 130,000 pounds, of which 102,000 pounds are on the drivers. The boiler, as will be seen, is of the extended wagon top style, and is 60 inches diameter at the front. The heating surface is 1,844.86 square feet, and the grate area is 25.05 square feet. The engine is capable of developing a tractive power of about 22,000 pounds in starting. The principal dimensions will be found on the engine diagram on page 66.

ROGERS TEN-WHEELER FOR MOBILE & OHIO.

The Drafting Room.

There is a vast difference in the way drawing rooms are considered, as well as in their equipment. The writer remembers an old shop where the boss never had a drawing made until he had completed a machine. After one had been finally induced to run without interfering, it was taken apart and one of the apprentices called to make sketches, with dimensions, of every piece. Then the boss knew the next one would go.

He didn't realize, however, that the first one would have run with very little changing if it had been laid out properly at the start, and that much money might have been saved by it.

Another old master mechanic on one of the Southern roads, right after the war of 1861-65, was his own draftsman and drawing room, too. His only instrument was his cane. He would go into the blacksmith shop and say, "Jim, I want you to get out a piece like this," and his cane would trace out something or other on the dirt floor. "Make it out of 2-inch iron, 6 inches here, 9 inches there, and 2 feet long. Understand?" And then one of his number tens would smooth it all down, so no one could see what it was. If it happened to be right everything was happy; but if it didn't come out as he wanted, the blacksmith caught it.

There are still too many who look on the drafting room as a place of record solely, instead of a source from which designs, dimensions for patternmakers, blacksmiths and machinists should emanate. It should also be an information bureau regarding the older machines and equipment.

While it is possible to make too much of this department and to have too many yards of red tape attached to it, it is generally under rather than over rated, and its full usefulness is not always obtained. Give the chief draftsman a chance and see if he cannot add its its value.

Plain Talks to The Boys.

BY C. B. CONGER.

The subject of firing coal properly is the one we picked out at the last meeting to talk about to-day. Of course, you all understand that coal is changed into heat in the firebox; this heat then goes into the boiler to change water into steam, so that we can use the steam to change this heat into motion with the engines. You see that the whole process is only changing coal into force or motion or power. If you want a large amount of power or force, by whatever name you call it, you will have to use a correspondingly large amount of coal. If we use steam fast, we must turn coal into heat fast; with a light or slow train we use less power than with a fast or heavy train, and it takes less coal to produce it. There is considerable waste in this process; part of the waste cannot be prevented by the fireman, but there is a large amount of the waste of coal that it is the work of the fireman to prevent, and it is of that waste we will speak later.

You have seen a poor-steaming engine that was using as much coal as should supply two good-steaming engines, each doing the work for a full train. Now, very likely part of the trouble can be charged against leaky valves and packing or poor machinery, but the waste that exceeds all others is the waste when the coal

is being turned into heat. Ability to prevent this waste is what makes the difference between a good fireman and a poor one.

Do not think we can say all that there is to be said about skillful firing in one lesson. Whole books have been written by different authors, and then some of the points are left unexplained.

We will talk about the practical and mechanical part of it, and leave the chemistry of combustion till some other time.

"Don't give us a lot of big words about the volumes of oxygen, the hydro-carbons, carbonic acid gas, etc.," you say? Well now, it is a hard job to explain how coal burns and makes heat without explaining about the changes the coal goes through while burning. As it changes from a solid substance to a gas which must mix with air before it will burn, we cannot explain it properly unless we use the names of all the substances produced during the changes. All of the coal does not change into a gas before burning; the solid parts burn from the outside similar to wood. But as you ask for an explanation of the mechanical operations with the chemical names left out, we will make a start. Very likely some of the chemists who can explain combustion better than we can understand it will get after us. They will have a right to, for chemistry is at the bottom of all explanations of combustion.

We will talk about firing soft or bituminous coal now, for firing hard or anthracite coal is another business entirely.

In the first place, soft coal should be broken to a firing size before it is put into the firebox, and the harder the variety is to break, the more need there is for breaking it up properly, as the harder varieties of bituminous coal burn slower than the softest varieties.

To make steam freely, it must burn up quickly; that is, it must get hot enough to roast all the gas out of it in short time. A small piece will get hot clear through in less time than a larger piece, and heat the solid parts of the coal so the whole lump will burn quickly. Very fine coal burns so fast that it explodes when you throw a scoopful of it on a good, clear, white fire.

The air coming up through the grates must get very hot while passing through the fire, or it will not mix with the gases and produce heat. If the coal is in large chunks, it will not lie close together. This will leave openings between the chunks, through which the air will pass in a large stream, and the center of this large stream will not get hot enough to burn when it gets on top of the hot coal in the firebox before it goes into the flues. If it does not burn before it goes into the flues, it is lost as far as producing heat is concerned. "How about the openings for air above the fire?" you say. We will take that up later in its proper place. Just now we are trying to have all the coal on the grates burn evenly and at its best gait. All of you know what the effect of a hole in your fire is. When you let your fire get thin so the exhaust tears holes in it, the cold air goes through the hole in a tremendous current, chills the firebox sheets and flues, so that the steam goes back on you, the coal around the edge of the hole quits burning. There is so much fresh air striking it that it does not make any heat. Now if the coal is in large chunks, there will be big air holes between them which will operate just the same as if there was a hole torn in the fire, only on a smaller scale. Enough of these moderate-sized holes will be as bad as a big one.

Then another point; the coal must be broken to a firing size, so as to present as large a surface on the outside of each piece for the heat to work on, and in this way be burning a larger proportion of the coal on the grates at one time, which makes more heat. To use a familiar illustration, if you want a quick hot wood fire to cook with, you do not put one single large stick of hard wood into the cook-stove and expect it to burn fast enough to make a hot fire. You will have the one big stick split up into a number of small ones and feed them in as fast as burned out. In this way you get a greater amount of heat in a shorter time than if the one big stick was put in and burned slowly on its outside.

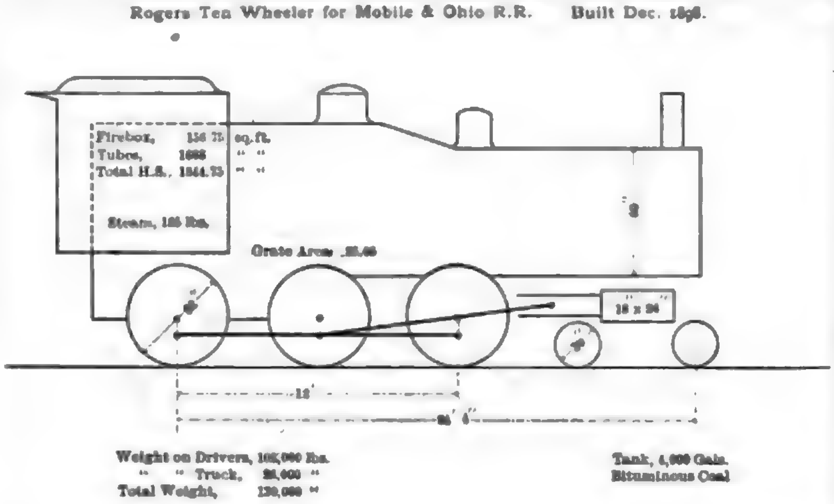
If you have a lot of big chunks in the firebox and throw fine coal in on top of them the draft between the chunks is severe enough to lift some of the fine stuff away from the grate and carry it to some other part of the firebox where the draft is not so severe. Coal is considerably lighter when it is heated hot; this will tend to waste that fine coal; it will go through the flues into the smoke arch. Every bit of coal that goes into the flues is wasted.

The ideal fire of soft coal is one that is made of small lumps not larger than a man's fist, spread evenly over the grate, so that the supply of air that is necessary to make it burn just right will come up through it evenly at all parts. It must be thick enough so that part of the air coming up through it will combine with the gases which are being roasted out of the coal and produce heat right at the surface of the piece of coal. If the air and gas does not get hot enough to mix down in the fire, it will not be hot enough to make the whole mass of coal burn at once. We want all the coal on the grate to be burning at the same time, as fast as it can, to make steam enough for a heavy train or a fast speed.

Locomotives have so little grate surface in proportion to the power produced by their boilers and turned into motion by the engines that we cannot give the coal time enough to burn in the most economical way. We have got to have steam enough, even if we use more coal than a good stationary boiler would need for the same power.

Do you see that point clearly? It is possible to have too thin a fire to make steam freely, as the air must get heated enough in passing through this fire to burn as soon as it gets to the place where it meets the combustible matter already in the firebox; this point is at the surface of the burning coal. If the air passes through without getting hot enough it will not turn into heat. With a soft free-burning coal and soft exhaust a very thin fire can be carried; for a slower-burning coal a thick fire is necessary so as to hold the air back and allow it time enough to mix while passing through the burning coal. This is just where the skillful fireman shows his ability, in so building his fire and keeping it of the proper thickness that it will make heat and not smoke. Heat is colorless, and while a certain amount of smoke comes from hard-worked engines, even with a good fireman, yet it is a popular delusion that a locomotive must make lots of smoke if

Rogers Ten Wheeler for Mobile & Ohio R.R. Built Dec. 1898.



Engine Diagram *Locomotive Engineering*

it steams well. If the fire is of the proper thickness and the draft through it is evenly distributed all over the grate, it should be a dazzling white color all over the grates, like an electric arc light. A skillful fireman recognizes the proper color when he sees it, although he may not be able to describe it exactly to a beginner. When you look into the firebox before putting in fresh coal see where the white spots are. That indicates where the fire is burning the fiercest and will likely need a supply of coal first. If part of the fire looks dead, it may be there is clinker on the grate, which prevents the air coming up through the fire at that point, in which case very little coal is needed there; it won't burn when you put on the fire. We avoid this in a measure by closing the door after each scoop of fresh coal.

Some engines burn their fire more at one end of the firebox than the other, and must be fired to suit. Better try and find out why this is so, and if a poor steamer, get her altered. Sometimes this difficulty is caused by an improper arrangement of the front end; sometimes it is on account of flues stopped up; at others it may be that the grate openings are not evenly spaced or the clinker has clogged the air spaces at one end. There is a reason for this trouble, hunt it up when you can. Some extension front engines fill up their front ends so it will affect their draft, and so little air comes through the fire in it in. If it is a clinker, lose no time in loosening it from the grates, breaking it up fine or taking it out entirely at the first opportunity. If the fire is banked at the black spot, level it off with a slash bar, or better still, put all your coal at other points in the box so as to burn out the bank. This is very apt to happen with fine coal. If the black spot is a hole in the fire where the coal has burned out, get a scoop of coarse coal in there quickly, so it will stop the rush of cold air through the hole as well as have a supply of coal burning on that part of the grate. An attentive, observant fireman does not have to fire very long before he can tell the cause of the black spot. As the engine burns the coal continuously, the fire should be fed in the same manner, not with four to six scoops at a time, then waiting till it burns down and loading in another charge. Put in one at a time when the train is light, or two at the most. It is no harder work than the other way of a whole lot of coal at a time and a so-called rest on the seat-box between times. The door should be shut each time between scoops of coal, in order to let the exhaust get some action on the fire to start the last scoopful to burning fiercely. This is of more importance than the amount of air going in the door in cooling off the flues. Just as soon as the door is opened it changes the action of the exhaust this case that the coal will not burn properly and makes no heat. Nettings may stop up. If with an extension front end the steam from the exhaust will come out white, there being no chance for smoke to mix with it. In these cases the defects can be cured at once by mechanical means in reach of the fireman and engineer.

To return to the proper method of handling the coal, so as to produce good results, beware of putting in too much coal when the boiler does not make steam. That is a common fault. When the gage goes back the fireman gets nervous and puts in more when that which is already in there is not burning as fast as it should.

Keep still and give the fire a chance to breathe. A fire needs air circulating through it just as much as a man needs air through his lungs. If there is a bad hole in the fire, very little black smoke will come out of the stack. As you put in fresh coal till you get a scoop of coal into the hole, then the thick black smoke will show at the stack instantly.

Let it be the aim of the new fireman to keep an even fire that is bright; fire a little at a time, and often; spread the coal evenly over the fire. He will soon catch on to a lot of facts about firing soft coal. "How will we avoid the waste of fuel you spoke about?" you ask. We will talk about that next month.

Baltimore & Ohio Southwestern Consolidation Locomotive.

The consolidation shown on this page was built by the Baldwin Locomotive Works for the Baltimore & Ohio Southwestern. It is a powerful, well-designed engine, the cylinders being 21 x 28 inches, and the driving wheels 56 inches diameter outside the tires. The boiler is straight, 66 inches diameter, made of 11-16 inch steel, and is designed to carry a working steam pressure of 190 pounds. There are 2,095.7 square feet of heating surface, and 32.7 square feet of grate area. The engine in working order weighs 158,000 pounds, of which 138,000 pounds rest on drivers. The tractive power is 35,600 pounds, and the ratio of adhesion 3.8.

BALDWIN CONSOLIDATION FOR BALTIMORE & OHIO SOUTHWESTERN.

A Mecca for Railroad Men.

Cedar Rapids, Ia., has been the Mecca of the pilgrimage of numerous railroad officials, since the method of firing followed on the Burlington, Cedar Rapids & Northern Railway was described in our December number. There have been representatives from all quarters of the continent, who journeyed thither to judge for themselves how bituminous coal could be burned without smoke. Nearly every pilgrim was at first inclined to think that there were circumstances connected with the smokeless firing followed at Cedar Rapids which would not be applicable to their road; but they were all moved to change that opinion. All were willing to admit before leaving that there was no favoring of engines to carry out a theory, and that the road was not only preventing black smoke, but was making as fast time and is hauling as heavy trains as any other roads.

We have received a copy of the Annual Report of the Chief of the Bureau of Steam Engineering, which makes very interesting reading to people interested in steam machinery. The report deals almost exclusively with naval affairs, and many interesting facts are given about our navy. The report was sent from the Washington Government Printing Office.

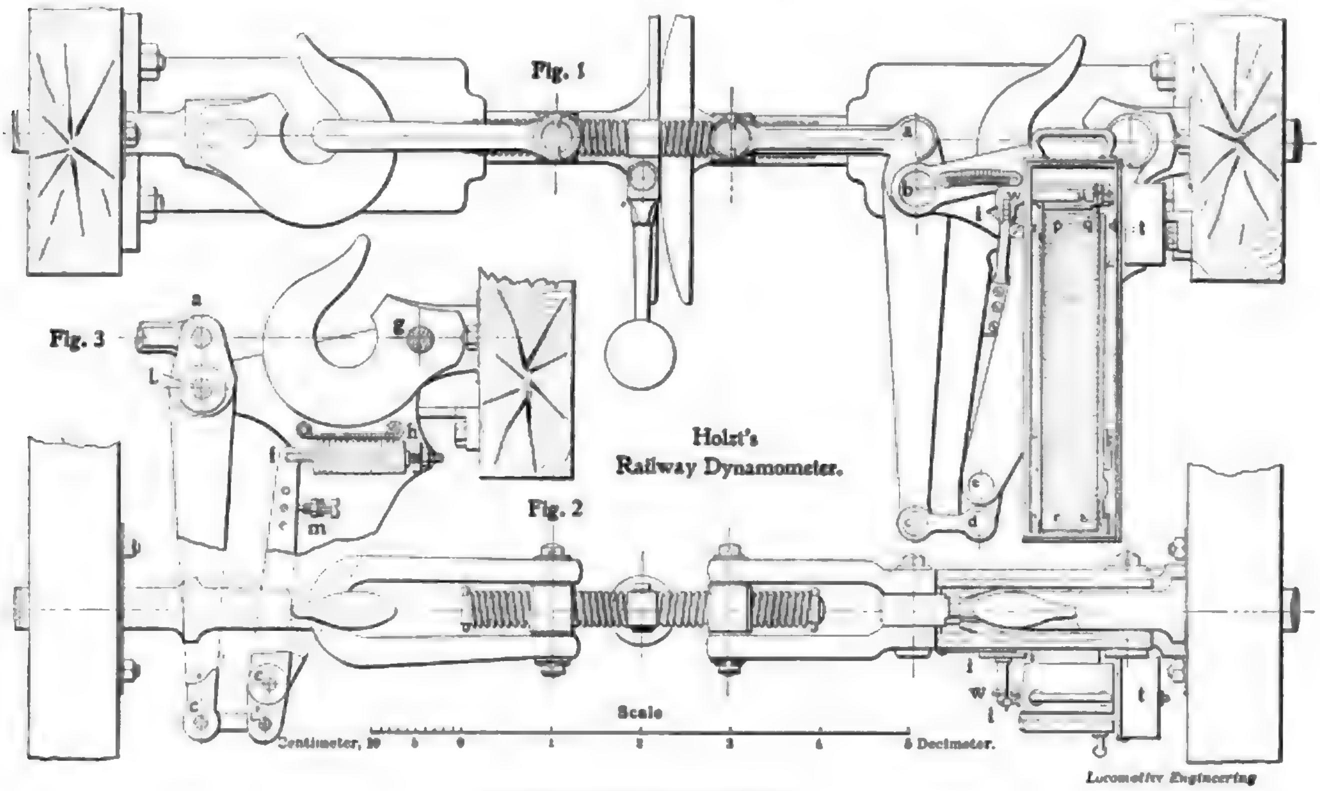
An Early Dynamometer.

At the Paris Exposition of 1867 we find a record of a railway dynamometer which was very complete in detail, especially for thirty-one years ago.

As the engraving shows, it was the invention of Mr. E. Holtz, of Bromberg, Prussia, a director of the Eastern Railway of that country at the time.

There is little need for description of the device, the engraving makes the mechanism of it clear to the reader. The card or diagram was traced on the moving band of paper *p q r s*, through the medium of the compound levers shown in the connections between bumper and car.

It was an ingenious device, and also shows the details of the coupling used on European cars very clearly.



EARLY RAILROAD DYNAMOMETER.

High Cost of Luxurious Cars.

There has recently appeared a detailed statement of the cost of constructing at the Altoona shops a sample, first-class, modern, up-to-date luxurious passenger car, and some of the items are of interest. The wheels and axles represent a cost of $332.35; the trucks upon which the car rests cost $553.62; the air brakes represent $131.75; the seat fixtures, 25 in number, cost $50.50; the three bronze lamps, $13.50; the two gas tanks, $84; the chandeliers, $50.72, and the item of screws, which might not appear to be an important one, $51.80. For the building of the car, 2,480 feet of poplar wood, 3,434 of ash, 1,100 of white pine, 2,350 of yellow pine, 450 feet hickory, 400 of cherry, 700 of Michigan pine, 500 of oak and 439 of maple veneer were required. There were required in addition 13 gallons of varnish, 45 pounds of glue and nearly 3,000 pounds of iron, exclusive of 800 pounds of iron castings. For the furnishing of the car, there were required 69 yards of scarlet plush, 44 yards of green plush, 61 yards of sheeting and 243 pounds of hair. The springs on the car seats cost $43.17. The basket racks cost $77.35; the sash levery, $42; the bronze window lifts, $24.40, and the gold leaf for the embellishment of the woodwork, $14.50. For the window fasteners, $15.47 worth of material was required; two stoves cost $77.56, and the tin used on the roof of the car, $41.44. The labor in the construction of the car represented a cost of $1,236.94, bringing up the expenditure to more than $4,400.

The requirements of this modern age demand coaches of the finest type, which must be run with the fastest and finest trains, and in case of a derailment or collision these palatial cars are reduced to fragments.

Allowing what can be saved from scrap-iron, the risk of running such fine cars is considerable, and the damage suits resulting from State laws are still more important.—*Pittsburgh Post.*

Big Order for Bridges.

One of the largest bridge contracts that has been awarded in many years has been let by the receivers of the Baltimore & Ohio Railroad. In order to place the lines west of the Ohio River in proper shape to handle the heavy freight equipment that is being used east of the river the receivers found it necessary to rebuild 51 bridges between Benwood, W. Va., and Chicago. That the structures might be rapidly pushed to completion it was decided to divide the work among three companies. The Youngstown Bridge Company, of Youngstown will erect 31 bridges on the central Ohio division, between the Ohio River and Newark, O.; the Pencoyd Bridge Works was awarded the 11 bridges on the Lake Erie division, Newark to Sandusky, and the Edgemoor Bridge Company, of Wilmington, Del., will erect the nine bridges needed on the Chicago division. The total cost of these bridges is in the neighborhood of $300,000, and it is expected that all will be in place by September. Nearly 6,000 tons of steel will be needed for the structures.

It has always seemed strange to us how the English people permitted the most valuable collection ever got together of drawings and data concerning their early railroads and railroad machinery to be sold to the Field Museum of Chicago, for they have a keen interest in such things. This was proved a short time ago at a sale of curiosities and relics held at Stevens's auction-rooms, London, when the Stephenson plan of the railway from London to Birmingham, a unique memorial of the railroad engineers G. and R. Stephenson, was sold for 26 guineas, equal to $126.

Excluding Weight of Engine and Tender From Weight of Train.

In our January issue we commented upon remarks made by a correspondent of a British engineering journal, in which objection was made to including the weight of engine and tender when calculating the work a locomotive had to do in pulling a train. Referring to what we said, the *Rochester Democrat and Chronicle* makes the following trenchant criticism:

"It is much the fashion with magazines devoted to scientific matters to indulge in criticism not unmixed with ridicule of articles in the lay press treating of technical subjects. That these criticisms are not entirely without warrant is true. It is not given to all men to devote their lives and activity to exclusive study on scientific lines; for pure science is not all of this busy life, and other, if less important, matters demand attention.

"While all this is unquestionably true, it must not be supposed that everything which is advanced in these technical periodicals, under the guise of scientific information, is entirely exempt from the criticism to which the non-technical press is subjected. In the current number of that excellent magazine, LOCOMOTIVE ENGINEERING, is a quotation from a London publication which is an apt illustration of technical journalism."

The salient points of the so-called scientific article were then reproduced, and the *Chronicle* continued:

"It is due to the editor of LOCOMOTIVE ENGINEERING to say that he characterized the article quoted as "silly stuff," but it would seem that the term used is scarcely adequate. Emanating from an ostensibly scientific source, it is, in an educational sense, more than silly; it is intrinsically vicious. The writer of this precious bit of scientific information is not an engineer. Indeed, it is to be doubted, judging from this deliverance, whether he would be able to pass an examination for admission to the kindergarten department of the Mechanics' Institute. Had he been capable of writing a child's primer of mechanics he would have known that even the weight of the steam admitted to the cylinders of the locomotive must be included in the gross load to be hauled along the rails. When the proposition was tried on a grammar school boy the lad instantly made the absurdity apparent by practical illustration in this wise: 'If I tie my coaster to a tree with a rope and tie another boy's coaster behind mine; then if we both get on our sleds and take hold of the rope and pull the whole outfit up the tree, you must count both sleds and both boys in the load.'

"The lad was right. He threw the question of traction co-efficient, with which the so-called scientific writer muddled his readers, out of the problem, and went at once to the question of energy excited to overcome the inertia of the sleds and their loads and keep them moving; which, in the case of the first sled, included the weight of the boy that exerted the energy.

"Applied science is, of course, unfailing, but some of the alleged phenomena of science recently promulgated in the technical journals will scarcely stand the test of applied common sense."

Iron Trestles in Austria.

We are indebted to Mr. Hermann Von Littrow, of Villach, Austria, for the very pretty views of the two iron trestles that are to be seen on the Ybbs Valley Narrow gage Railway in lower Austria. The gage is 2 feet 5⅞ inches, and the line has a grade of 3 per cent.

The hight of one of these bridges is 70 feet and the other 100 feet. On both bridges the line is on a curve of 196 feet radius. The locomotives that are seen on the bridges are Golsdorf two-cylinder compound, with two-axle (double) truck, and simple engine with pony truck of the Helmholtz pattern on the rear are used. Both types are visible on both bridges united as a bridge test train.

IRON TRESTLES IN AUSTRIA.

Advice on Mechanical Subjects.

"Advice," says the proverb, "is easy to give, but hard to take." We don't exactly agree with this if we consider the future in the least, as it is not always easy to give advice or even an opinion and retain the friendship of the listener. This is particularly true of advice as to the value of mechanical devices when the inquirer is either the inventor or an investor in it.

We were once in the office of a friend who is quite an authority on steam engine matters, when a young fellow came in with a roll of blue-prints and said he had been recommended there for opinion and advice. After looking it over our friend said: "My friend do you want an honest opinion or do you prefer taffy?" An opinion minus the taffy being called for, he remarked: "Well, personally, I don't think it's worth a d——, but you may find somebody who will put money into it." This advice, though easily given, probably made an enemy who will declare the party to be an old fogy, or prejudiced, or both.

A somewhat different phase of the advice question comes out when we find a

man who has invested money and then wants to know the value of the device. This is even more delicate than the other and comes pretty near to calling a doctor after the patient dies.

If you find the machine is of no merit and tell the investor so, you either reflect on his judgment or his common sense in investing before consulting you, or he gets the impression that you are not much of a mechanic anyway.

He trots out reported tests by John Jones, M. E., C. E., D. F., and other things which may or may not equal Tom Pray's report on the Bates Thermic Engine; tells you of eminent experts who have pronounced it a marvel and wept by the bucketful because they couldn't buy any stock; shows you orders for dozens of the machines; proves that a little 5 horse-power of this particular kind is equal to 15 ordinary horse-powers, etc., etc., and thinks you are an idiot because you don't swallow the whole dose without salt.

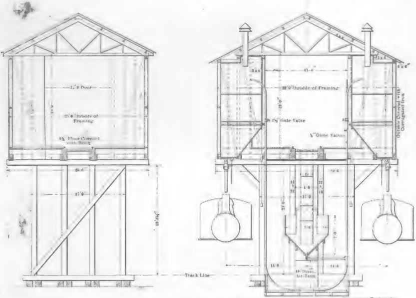
We hope the time will come when a mechanic will be consulted the same as any other expert, and not after the money has been thrown away or the reputation involved.

Pneumatic Sand Hoist, Baltimore & Ohio.

At Cumberland, Md., shops the Baltimore & Ohio have installed their standard coaling station, which has in connection a sanding system of no less importance than that for coal. The sanding features of the plant are the subject of our illustrations, a reference to which in Fig. 1 shows sectional elevations of the sand drying house, the section at the left being taken through the drying floor, and shows the floor covered with 1½-inch steam pipe, resting on brick, on which the sand is dried. The section at the right is taken at the center of the house through the sand storage bins, under which engines may be supplied at each side at the same time, by means of telescope pipes shown reaching from the pocket to sand box, sand flowing by gravity when valve is opened by the handle shown at the side of the pipe.

The sand is elevated to the drying floor in cans and spread over the steam-drying pipes. After drying it is sent down through the chutes shown in Fig. 2 to the hopper shown in Fig. 1. This hopper is in communication with an air reservoir 48 inches diameter and 60 inches high, from which the sand is elevated to the bins above by compressed air. The reservoir and piping system is shown in Fig. 1. A detailed view of the valve between the hopper and reservoir is shown in Fig. 3. This valve controls the passage of sand from the hopper by means of a 5-inch cylinder above the valve, the latter being at the lower end of the piston, which is operated by air, and is in the position shown when sand is being elevated to the supply pockets.

All sand is screened after entering the chutes by passing through a steel wire netting 2½ x 2½ inches mesh, an operation quite necessary on this system, for the reason that the sand used is of the manufactured kind, that is, pulverized stone.

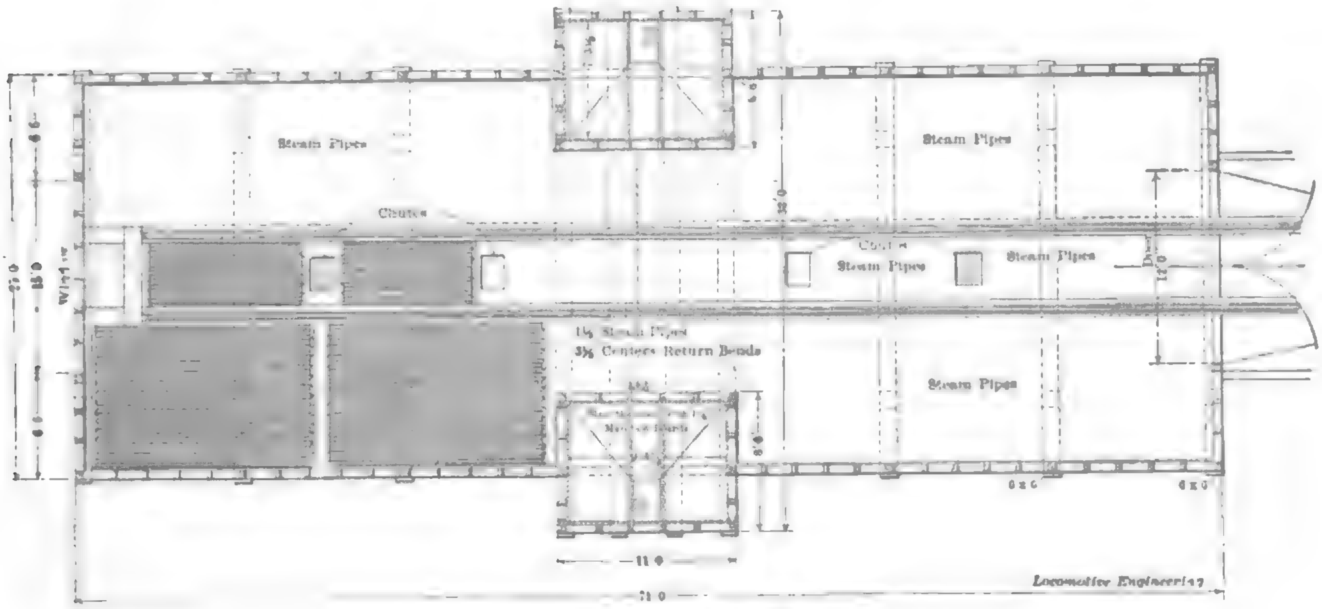


PNEUMATIC SAND HOIST. FIG. 1.

The latest manifestation of government industrial stimulation in Russia is the equipping of metallurgical works where armor plate suitable for battle ships will be made. An old establishment is undergoing rebuilding on the plan of the Krupp works in Germany, and will be provided with means for manufacturing from the raw material nearly every article used in a battle ship.

Compelled Speed of Express Trains to be Reduced.

It is never safe for people of country towns to spite railway companies by making them obey stupid ordinances requiring the speed of passing trains to be reduced to a slow pace. The authorities of Atherstone, a small English town, have compelled the London & North Western express trains to reduce speed to four miles an hour, and the people of the place derived great amusement from watching the trains crawl slowly past. They are not so happy now. The railway company discovered that a more direct line with better gradients could be constructed, which left Atherstone out on a side track, and this improvement will be carried out. The natives are now clubbing each other for bringing on the disaster. They will not be troubled any more with fast trains.



PNEUMATIC SAND HOIST. FIG. 2.

Interesting Railroad Landmark.

The first iron rails that formed a continuous line from tidewater to the Ohio River were laid forty-seven years ago, and the work was completed on Christmas Eve, 1852. It is quite well known that the projectors of the Baltimore & Ohio Railroad conceived the broad idea to bring Baltimore, on the Atlantic Coast, into close relations with the great and the then being rapidly settled Ohio Valley, would augment the gold in the strong boxes of the Monumental City. After many obstacles had been thrown in the way, and in turn surmounted, the line was completed, and a trainload of proud Baltimoreans journeyed to Wheeling, W. Va., and watched the turbid Ohio flow by on to the sea.

The completion of the laying of the iron rails (steel being too expensive at that time) is marked by a natural monument, eighteen miles from Wheeling and near Roseby's station. This monument is a great stone on the hillside, and is located in Marshall County, W. Va. It is 60 feet long, 35 feet wide and 30 feet high. Commercially minded men have estimated that it is worth $200 for building purposes, but it could not be purchased, because of its historical association with the completion of the main line of the Baltimore & Ohio Railroad.

Cut deeply into the side of the rock that faces the railroad track is the following inscription: "Roseby's Rock. Track connected Christmas Eve, 1852.—Hobbs & Faris."

The men who immortalized themselves in Baltimore & Ohio history were the stone-cutters who cut the inscription, but the rock gets its name from Roseby Karr, an English engineer who was in charge of the track-laying from Wheeling, eastward.

Those were the days when liquor flowed more than freely on state occasions, and there was no oversight or neglect of custom when the rails were connected. Whiskey was purchased by the barrel and when the last spike was driven all hands proceeded to get gloriously drunk and celebrate the event in a manner acceptable to tradition. There was no time to waste on faucets or bartenders. A sledge hammer was better than an augur or a bung-starter, and the heads of the barrels were promptly knocked in. One of the enthusiastic trackmen fell into a neighboring run and was drowned. The stream is now known as Grave Creek.

Karr, the engineer, had several interesting experiences with his men. One of them, Abner Charnock, objected strenuously to working on Sunday, and one Saturday night, in order to carry his point, chained the locomotive to the rails. Karr and Charnock had hot words, and a rough and tumble fight followed. The Christian downed the Sabbath-breaker, and while holding him remarked calmly that "Man was not made for the day, but the day for the man."

Years later Karr was struck on the head with a hatchet, by one of his men, on the Parkersburg branch, and was killed. It was reported that the blow was accidental. Charnock died in 1896 near Cameron, W. Va.

Recently Roseby's Rock has been cleaned and repainted, and is quite patriotic in appearance, the artists using the National colors in profusion.

Liquid Fuel in the Navy.

There is a curious incident mentioned in the annual report of the Chief of the Bureau of Steam Engineering, which illustrates the conflicting interests we hear so much about in the navy. It was determined to make some tests of liquid fuel to find out to what extent it was adapted for use in the navy, and a small torpedo boat belonging to the Ordnance Bureau was lent to the Bureau of Steam Engineering for experimenting purposes. Changes were made in the furnaces to adapt the boiler for burning liquid fuel, and the boat was put in regular daily service to ascertain the cost, reliability and general satisfaction of the fuel, and it was found to be entirely satisfactory.

When the boat, however, was returned to the Ordnance Bureau, the commander of the torpedo station reported that the use of fuel oil was more expensive and less satisfactory than coal, and that the boat was less available and less reliable than when using coal. On account of

that report the fuel apparatus was taken out. The Chief of the Bureau of Steam Engineering said in regard to this incident: "It would seem that the apparatus gave satisfaction when under the control of a competent officer; its failure in regular service was not due to any inherent defect, but to indifference or lack of acquaintance on the part of those who handled it. The bureau does not consider this experience as at all unfavorable to the use of oil fuel, but anticipates that its use on a larger scale, under the direction of a skilled engineer, will prove entirely satisfactory."

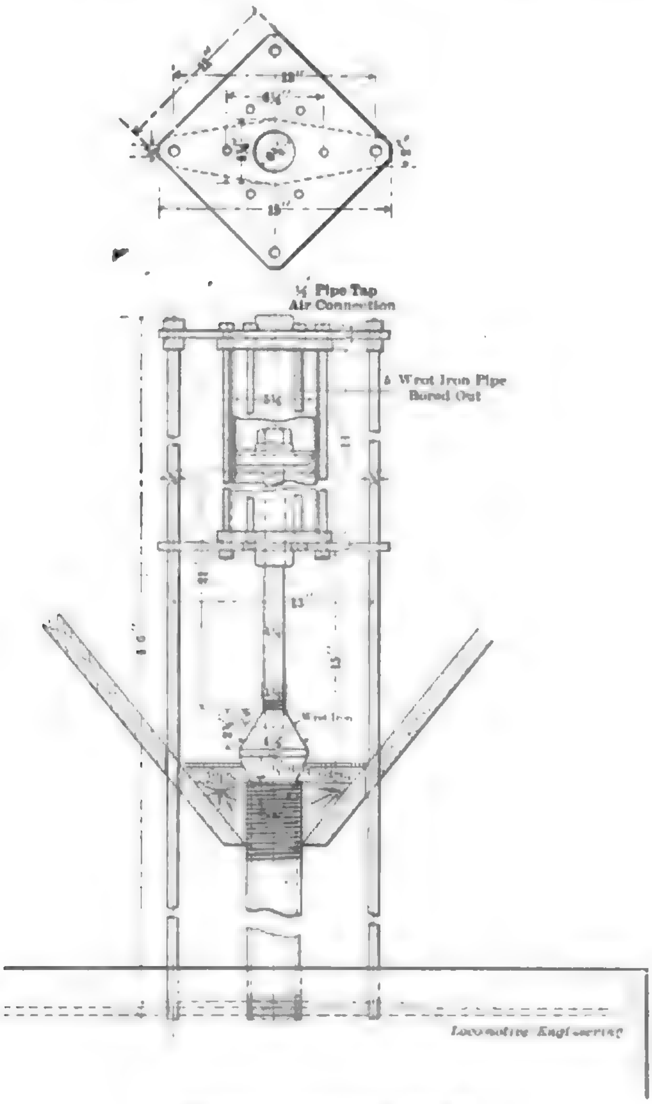
The Strong Balanced Locomotive.

After several attempts to haul a train on time on the New York division of the Pennsylvania Railroad, the great and only balanced Strong engine has given up the ghost, so far as that road is concerned.

The repair tracks of the "Meadows" shop got intimately acquainted with this wonder during its short visit to the road, and it was quite a philanthropic machine in the way of giving work to the repair men before Christmas.

One of the engineers remarked that he "didn't doubt she was balanced, but when they could coax her up over thirty miles an hour, the dufangles began to drop off and decorate the roadbed."

The grand finale, however, was "jes fore Christmas," when she made a bold attempt to get from Jersey City to Waverly—a distance of nearly twelve miles. She didn't get there, however, and blocked the road for an hour or so, holding five or six through trains and as many locals. Finally orders went out from headquarters to push the thing on a side track somewhere, regardless of damage it might do to the engine—probably thought it was strong enough to look out for itself. Balanced engines are fine things, but it seems to be an open question how far you can go—both in expense and delay to traffic—to warrant running one of them.



PNEUMATIC SAND HOIST. FIG. 3.

Fitchburg Vauclain Compound Passenger Engine.

This engine shown on page 74 is one of the most powerful looking passenger locomotives that we have ever examined. While on a visit to Boston a short time ago an official of the road was kind enough to invite us to ride on the engine, and he added the inducement that he would prevail on the engineer to let us run the engine after we were clear of the switches and signals near Boston. It was only then that a lapse of sixteen years in handling locomotives was realized in its full meaning. On reflecting over the offer we felt that we could no more handle that locomotive successfully than if we had never spent years handling the throttle to move smaller locomotives into their best speed. We were accustomed to looking down daily from an office on a 15-story floor, but to control a locomotive at the altitude this one seemed to hold appeared to be doubling the distance.

As will be seen from the engraving, the engine is a ten-wheeler with two cylinders on each side. The cylinders are 15 and 25 x 26 inches, and drivers 78 inches diameter. Without the help of indicator diagrams we cannot say with exactness what the tractive power will be, but the boiler pressure being 200 pounds per square inch we think that the engine will develop about 25,600 pounds in starting.

The general dimensions are: Boiler, extended wagon top, 60 inches diameter in front, firebox 120⅛ x 41¼ inches, depth varying from 61 15-16 to 75 3-16 inches; tubes 328 2 inches diameter, length 15.1; heating surface 2748.47 square feet; grate area 34.48 square feet. The weight in working order is 150,000 pounds, of which 111,000 pounds are on the drivers. The engines are very highly spoken of in the way they handle the heavy fast passenger trains run on the Fitchburg Railroad. More particulars about this engine will be found on the diagram, page 83.

Compositions for Brass Castings.

Locomotive Driving Brasses.—1 part tin, 6 parts copper.

Brasses for Solid Journal Bearings for Engines and Cars (Freight Cars).—1 part tin, 7 parts copper.

Locomotive Trimmings, Cocks, Valves, etc.—1 part tin, 1 part zinc, 10 parts copper.

Low-Grade Brass Castings.—All scrap.

Filled Engine and Car Journal Bearings.—For Shell, all scrap; for filling, 1 part antimony, 6 parts lead, 1 part tin.

Genuine Babbitt Metal.—4 pounds copper, 4 pounds antimony, 96 pounds tin.

Bearings for Passenger and Tender Journals.—For shell, 1 part tin, 7 parts copper; for filling, 1 part antimony, 6 parts lead, 1 part tin.

For Lined Journal Bearings.—For brass, 1 part tin, 7 parts copper; for lining, pure lead.

General Correspondence.

Injector Attachment.

You will please find enclosed blue-print of a heater for injector, feed and supply pipes on locomotives, keeping them from freezing up in winter, also acting as a squirt for wetting down coal in summer.

It is the universal practice equipping locomotive with a drain-cock to branch pipe located near the check valve to boiler, keeping this cock open when injector is not in use and opening steam-ram to injector a little, keeping a flow of live steam through branch pipe, keeping it from freezing up in cold weather.

This practice is a great nuisance, as the steam from waste pipe entering the atmosphere makes a large volume of mist, obscuring vision of the engineer and fireman; also condensation from waste pipe flying back on links and other parts of machinery, stopping up oil ways and covering over machinery with ice, cutting link and saddle pins and causing them to break off and damaging other parts of machinery. In above cut will be seen a hole is tapped into steam fountain or boiler head, a nipple and T put in a globe valve, connected on each side of the T and run ½-inch pipes from globe valves down near footboard, and then put another T extending pipes under lagging to near check valves, connecting them to branch pipes. Bring other pipes from T's located near footboards back to rear of cab, having a globe valve located in these pipes. Attach hose at rear end for a squirt.

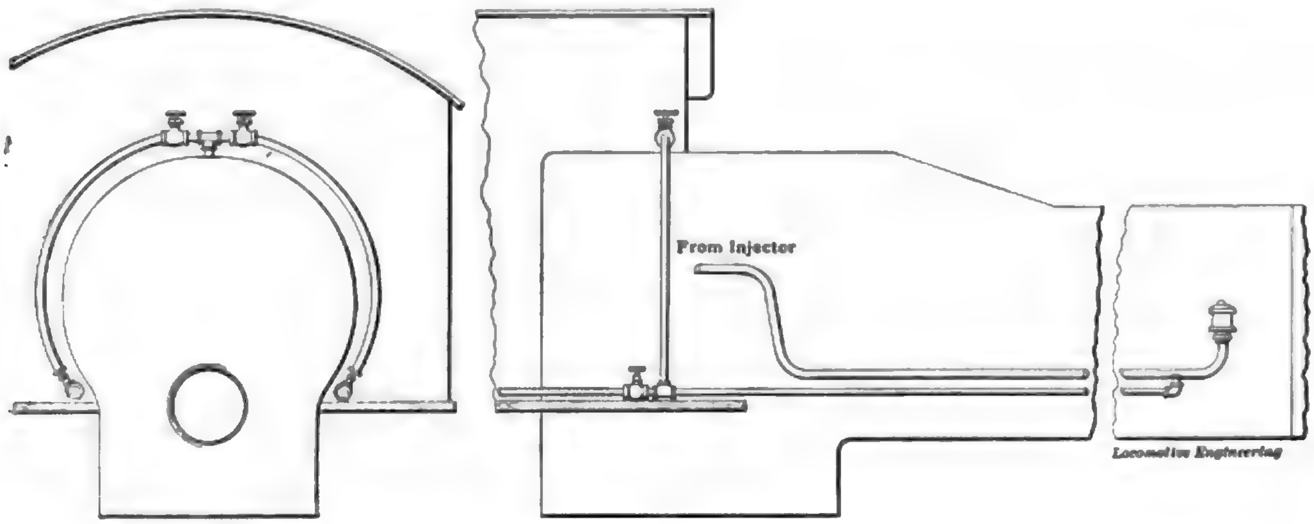
Now it will be seen that these heaters can be put on or shut off at will of engineer while running, doing away with steam flying around engine, getting all waste steam into tank where it belongs, and no damage to machinery. Whichever injector is working you have a squirt by simply opening globe valve near running-board.

Anybody interested in this can try it. It is not patented.

If line checks are used drill a ⅛-inch hole through line check valve.

I. F. Wallace,
C., St. P., M. & O.

Altoona, Wis.



Railroading in Africa.—Part II.

Before the advent of the Beira Railway, everything was carried with Kaffir packamusi trains past the fly belt. There are four distinct belts of these noxious flies between Fontesvilla and Chimoio, one in the vicinity of Seventeen Miles, one at Forty Miles, one about Seventy-five Miles, and another at about One Hundred and Four Miles. They are called the Tsetse, or blue fly. Their sting is fatal to horses and cattle. From the terminus of the road ox and mule teams transport the freight. However, the rindepest caused the loss of nearly all cattle in the country in 1896 and 1897, and merchants and shippers again had to resort to Kaffir carriers. Many mules were imported from South America about that time. The railway now is so far laid and in operation, and a number of traction engines are worked from different points along the line, that ox and mule teams are almost, and in the near future will be entirely, dispensed with for long-distance hauling.

There was one grand feature connected with railroading on the Beira line—the Pungive flats are literally alive with immense herds of buffalo, antelope and other large game. Lions are also numerous. Herds of elephants have frequently been seen crossing the track at Twenty Mile peg. An old rhinoceros kept the section foreman and his gang up in trees nearly all one afternoon about two years ago. I have seen from 500 to 1,000 buffalo in a herd not more than 600 yards from the track. Have often seen lions crossing the track at night by the headlight, also in daytime. I have frequently shot antelope and buck, with very little delay to the train. Guinea fowls and other feathered game are also plentiful. I have shot as many as eight in one shot from the engine, while moving, through the front cab window. Guinea fowls happen on the track a great deal when the grass is long. I always carried a rifle and shotgun on the engine. It was, in fact, the only way we had of getting fresh meat. At times we used to get very tired of Armour's tinned Bully Beef, and we were accorded the privilege of shooting game for use by both the company and the government. This hunting business, however, is stopped now. Last January the government passed measures prohibiting the killing of game, under heavy penalty, without purchasing a hunting license, which is very expensive.

It used to be very dangerous for a guard to go back at night to flag, on account of lions, especially near Eighty Miles, where an old lion had been known to kill a number of Kaffirs, and became very bold. He went through the kitchen at the hotel at Eighty Miles one night, and the next night killed and devoured a Kaffir at the section-huts house. A few nights after, I baited him with a goat, and was successful in killing him. The general manager, Mr. Moore, and the chief engineer came out to look at the old fellow, as I came past their house while bringing him to the station on a hand car.

In fact, lions are still dangerous in many

places along the line. As game becomes scarce, they become more bold and vicious. I remember one night at Sixty-two Miles, I had a guard, by name Wisdon, an American. While I was taking fuel, he went back to flag the following train. When about fifty yards from his train, a big hyena gave a yelp, and Wisdon made a run for the train. I was oiling at the time. He came running to where I was—no hat, and his hair all seemed to be standing up straight. We went back, but were not disturbed again. A hyena, however, is not very dangerous.

I have had nearly eighteen months of continuous hunting since I left the Beira Railway—just enough to make one wish to discard civilization with all its comforts, and take up his abode in the haunts of wild game.

Everything considered, the men who have carried forward the work of constructing this railway, in face of the many almost insurmountable difficulties to be overcome, when all materials had to be shipped a great distance by sea, and no transportation facilities on land, deserve the highest praise; especially Mr. A. J. Lawley, who has furnished the brain, push and energy in the construction of this line. He is a just and generous man, and highly esteemed by all the men on the road. It is to be hoped that Mr. Lawley will survive the ravages of that formidable fever for many years, as he and many more of his stamp are needed to open that vast northern region to civilization.

Mr. Arthur M. Moore, who was formerly general manager, I may also add, is one of the best of men.

Time will doubtless improve things on the Beira Railway. Guided by experience of the past, the management will no doubt make changes that will be a benefit to themselves as well as their employés.

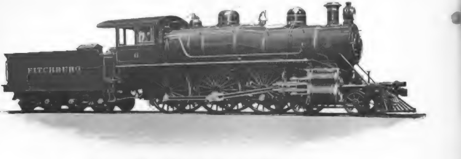
A survey has been made from Beira to Senna, on the Zambesi River, for the construction of a new railway by a French syndicate.

Work began in Beira November, 1897. I was told by the Governor in Senna in October, 1897, that the company were then trying to float bonds in Europe in order to push the work forward as soon as possible. The distance of the survey is about 230 miles. I have traveled over the greater portion of the route. It is fairly level, and there will not be any great amount of grading. It will pass through a beautiful scope of country, well watered, and plenty of timber, easy of access, and a dense Kaffir population at the Zambesi end of the line, where the company will be able to get the greater part of their labor. Malaria and black-water fever are prevalent and form one of the great drawbacks for this company.

The Pretoria and Pietersburg line, in the Transvaal, is almost completed, which is about 180 miles in length. It connects with the Netherlands system at Pretoria. They are using mostly Netherlands engines at present, but will probably stock their road with English machinery and rolling stock, as it is an English syndicate.

In conclusion, I may say it might be a boon to railroad officials in this country to have a good number of our watchful eagle-eyes drift over here and enlist in their service; but I may also add, railroading is not the best paying game in this country, and is not what we are accustomed to in the States.

P. E. STELLWAGEN.



VAUCLAIN COMPOUND ON THE FITCHBURG RAILROAD

Wear of Cylinders.

There seems to be a difference of opinion in regard to the cause of the cylinders of a locomotive wearing, the one on top, and the other on the bottom, when presumably the working conditions are the same in both cylinders. I have observed of locomotives of the same class, while in the shop for a general "overhauling," including re-boring the cylinders, that the wear is as liable to be on the top of the cylinders as on the bottom.

At the Lehigh Valley Railroad shops, at South Easton, it is a common sight to see cylinders on the same type of locomotive, which after running eighteen months or two years, have worn nearly ⅛ inch, either above or below, as the case may be; and sometimes above on one side and below on the other. No doubt many erecting shop foremen have noticed this; and the machinist in charge of the portable cylinder-boring machine is also probably familiar with the "ins and outs" of the phenomena.

Of course the cylinders will wear somewhere, and, theoretically, if the crossheads and pistons are properly aligned, this wear should be on the bottom of the cylinders on account of the weight of the piston. Is then, the reason for the wear sometimes being above attributed to any of the following causes?

First—The improper lining of the guides. The probability of the wear on the top of the cylinders coming under this head is a minimum, because the guides at the above mentioned shops are lined a full 1-32 or 1-16 inch high in the back, thus allowing amply for their lowering into line with the center of the cylinder, which will take place owing to the boiler settling back, due to expansion from heating, and thus causing the guide yoke and guides to lower. Hence the crosshead is not too low, and the piston, the stuffing-box being fixed, is not caused to "ride high" or be forced against the top of the cylinder on this account.

Second—The unstability of the crosshead. The wear and lost motion in the crosshead might cause "wobbling" of the piston head, and a consequent uneven wear of the cylinder.

Third—The inertia of the reciprocating parts. Is it possible that the wear on the top of the cylinder is caused by the reciprocating parts catching up on and pushing or pulling the piston, thus causing a change of stress from tension to com-

pression, or *vice versa*, in the main and piston rods, and, in running ahead, causing a change of pressure (near the ends of the stroke) from the top to the bottom guide, which would cause the piston to jar and knock against the top of the cylinder?

There are doubtless other considerations which I have not mentioned, but in any case the mere existence of the above facts is cause for an investigation into the apparent irregularity.

O. H. SYMINGTON.

317 Bushkill Street, Easton, Pa.

[Our correspondent names all the theories which we are acquainted with for causing the uneven wear of cylinders. If any of our readers are familiar with other theories we should like to hear from them. —Ed.]

Not the "Chicago" Great Western.

I notice in your January issue under the caption of "Criminal Wheel Fitting" a reference to a derailment of a passenger train on the Great Western Railway, due to the shifting of one of the truck wheels under a coach. If there has ever been an occurrence of this sort on this railway I am not aware of it, and if this refers to the Great Western of England, I think that you should say so.

TRACY LYON,
Master Mechanic.

St. Paul, Minn.

Valve Setting.

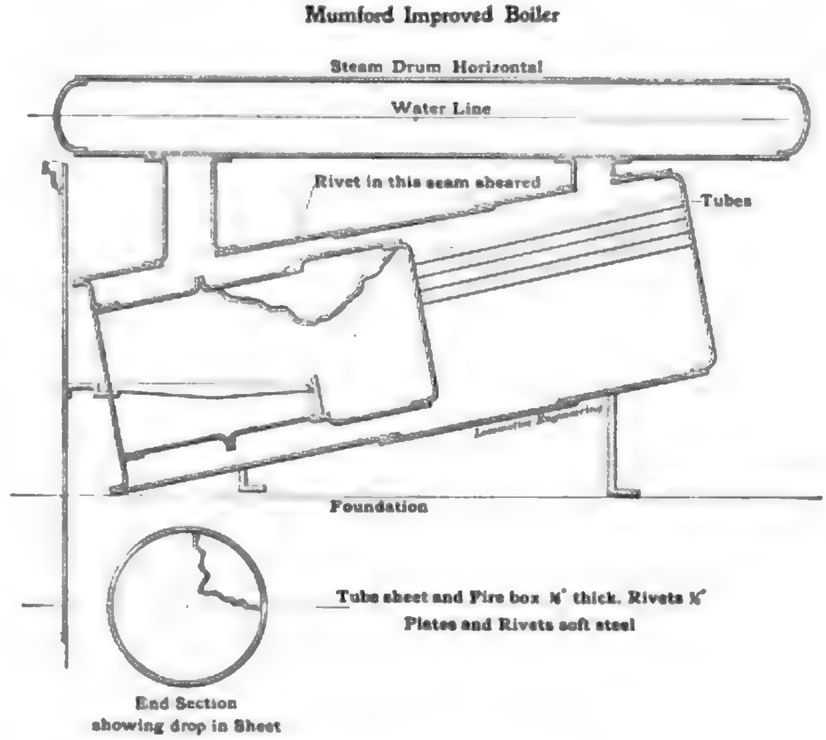
I have read with considerable interest Ira A. Moore's article "How to Set Valves," but I wish to take the following exceptions: One is to the way that he gets his openings. He takes his point from stuffing-box of steam-chest. I think that in practice he will find that it is almost impossible for him to get his steam-chest cover down without moving his chest, in which case his marks on valve-stem would be wrong, and every time he took off steam-chest, he would have to take points on valve-stem again. It is preferable to take the mark on some immovable part of the engine, for instance, the cylinder, right below the steam-chest, and use a tram with one straight end. This would avoid trouble from this source. Furthermore, his way of getting the lead is not quite the thing. I consider that the best way is to take a piece of metal of the same thickness as the amount of lead that you wish to give engine, insert it in the ports, and bring your valve up against it in both front and back ports, marking your valve-stem in this position. The points found in this manner can be used the same as the points found as per his article; and, in getting the lead, move the eccentrics as stated by him, until the tram falls into the mark on valve-stem. According to his article, he gets twice the lap between his tram marks on the valve-stem. According to the above he gets twice the lap and lead on his valve-stem. It is really the same thing; but it seems to me a little more simple.

HUGO SCHAEFER,
M. M., Phila., R. & New Eng. R. R.

Hartford, Conn.

Curious Collapse of Boiler.

I enclose rough sketch of stationary boiler in which firebox collapsed a few days ago. This boiler was installed new December 15, 1897, hence was in operation just one year. Tested to carry 125 pounds steam pressure, but owing to being connected with a battery of seven other boilers, some of which only carry 80 pounds, this pressure has never been exceeded, excepting probably this one case. Gages, however, on all boilers only indicate 80 pounds. Some of your readers would probably like to give an explanation as to this cause. The plates are not fractured; some of rivet holes are drawn, but in no case a break.



CURIOUS COLLAPSE OF FLUE SHEET.

May say that about one year since we had a return tubular boiler (guaranteed for 125 pounds pressure) give way, or rather drop 2½ to 3 inches, starting near brick work on both sides directly over fire, taking in 4 feet 6 inches in radius of boiler and 4 feet lengthways of boiler. Carrying only 80 pounds pressure, this boiler showed no leak after depression of plate. There was a little soft mud, but not enough to do injury. In neither case was there a shortage of water. In accompanying sketch you will note several rows of tubes at front end are above line of crown sheet. Tubes not affected. Water used is fairly good, being river water.

T. MCNABB,
M. M., Alberta Rw. & Coal Co.

Lethbridge, Ala.

Keying up Main Rod.

While reading your valuable paper, I saw Mr. I. B. Rich's statement in regard to keying up main rod on a locomotive. Mr. Rich says that a main rod should be keyed up on the quarter. I say the proper place to key up any rod, main or side rod of a locomotive, is on the dead center. I must say that Mr. I. B. Rich could not have had much experience with worn pins. I would like him to tell me how many wearing points a pin has. I have run a locomotive with the pin worn out of round over half an inch. Now what would you do in case you keyed the pin on quarter with half an inch out of round, so there would be no pound, with pin worn as much as this one was? What would be the consequence? I again say, there is but one place to key up a main rod on a locomotive, and that is the dead center. I would like Mr. I. B. Rich to tell what expansion has to do with keying up a main rod. I say you can key up a main rod when it is cold just as well as when it is hot.

F. M. DONNOR,
An engineer of over thirty-five years experience.

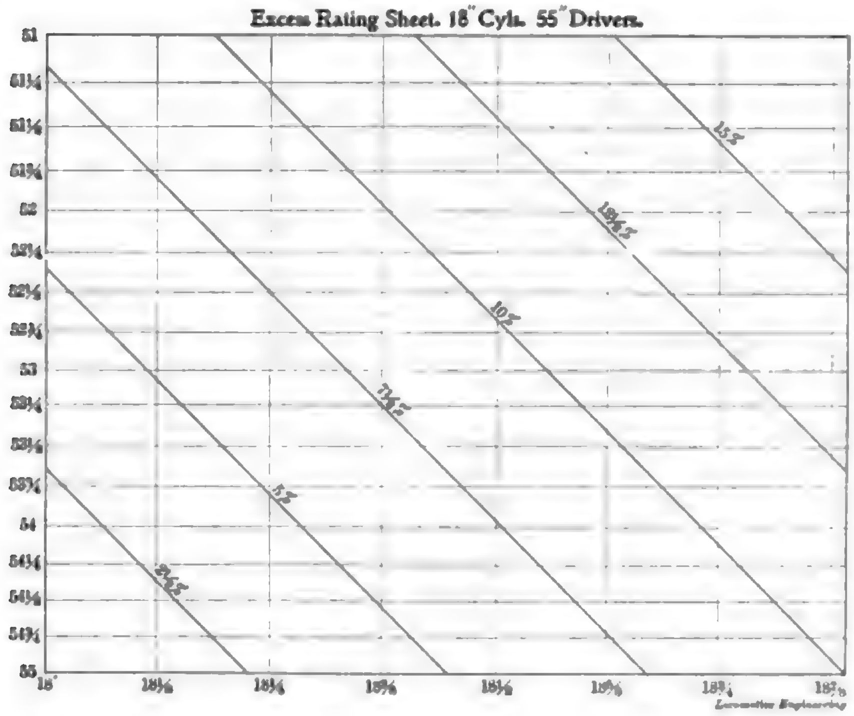
Selma, Ala.

Excess Rating.

It may not strike the ordinary observer that an old engine may be more powerful than a new one, yet such may be the case, and it is the purpose of this article to demonstrate how this increase of power may be measured and taken advantage of in tonnage rating.

With new cylinders and tires the engine is capable of exerting what we may call a normal amount of tractive power, but as the tires are worn and turned down and the cylinders are bored, there is a very appreciable increase of power with the same steam pressure. After each shopping this excess power can be calculated and established, so that engines of the same class may be equitably loaded, notwithstanding their varying diameters of cylinders and drivers.

Excess Rating Sheet. 18" Cyls. 55" Drivers.



The accompanying illustration shows how this information can be charted graphically, and the excess ratings read at a glance. This one is calculated for 18-inch cylinders and 55-inch drivers when new. The lower left-hand corner is the base, and from it rise the driver diameters in regular intervals, depending on the increase in power. On the lower line are the increasing cylinder diameters, arranged in the same rate of increase. Diagonals are then drawn connecting certain like percentages of increase, and enclose a field of combinations that may for convenience be grouped as taking the increased rating denoted by the lower diagonal boundary.

Suppose, for instance, an engine of this class is turned out with drivers 52 inches diameter and the average bore of the cylinders 18½ inches. By following the lines which these dimensions indicate, we find their intersection in the field marked 10 per cent., and therefore assign that engine 10 per cent. excess rating.

If the ruling grade on a freight division calls for a rating of, say, 600 tons between tender and caboose, then the above excess rating would add 60 tons to the regular rating in order to load the engine equitably with others that may be normal in their dimensions. C. A. SEELY.

St. Paul, Minn.

In the Navy.

Oiling one of the old, slow-running marine engines called for more skill and dexterity than is required in one of the modern high-speed marine engines afloat, as in the latter case, the engines are mostly all vertical and are provided with a multitude of oil pipes leading to all important bearings. Again, hollow screw shafts and cranks are an important factor in cool running. The almost total abolition of keyed rods is another help, they being replaced by the present T-head rods. And last, though not least, is the adoption of well-fitted babbitt bearings in both crank, thrust and main bearings.

The new crank shaft for the U. S. S. "Hartford" has bearings 13 inches diameter, and with a 5-inch hole through them. No, the hole does not add to the strength of the shaft. The great drawback to the cool running of solid screw shafts is the internal heat. The bearing may get hot, and be cooled off to all intents and purposes, so far as we can tell by feeling it on the surface; but the internal or stored heat soon develops itself, and things are as bad as ever. With the hollow shaft there is no metal in the center to retain heat.

It sometimes happens that in time of heavy weather, or when the ship is taking much water on board, it is necessary to start the bilge injections, which of course calls for the services of one of the oilers to look after the strainers, that they do not get stopped up by waste and other flotsam drifting around in the bilges. The writer has a very unpleasant recollection of lying down between the main cylinders and reaching down into the bilge water to clear the injections. Boys, did you ever smell "bilge water?" No doubt the S. P. of LOCOMOTIVE ENGINEERING can tell you something about it. I speak of the bilge injections; and no doubt some may ask, what are they? They are valves located close to the bilges (the bilges are the spaces in the bottom framing of the ship), and connecting them with the condenser.

You no doubt know that a low-pressure or condensing engine exhausts into a condenser. A condenser is a vessel, cylindrical or square in form, and contains a large number of brass tubes about ⅝ inch outside diameter and averaging 5 feet long. The number of these tubes runs up into the thousands. These tubes are what is designated cooling surface. The cooling surface in the main condensers of the *new* "Maine" is over 9,000 square feet. Connected with the condenser is what is called a circulating pump. The interor of the condenser is so constructed that the circulating pump keeps a continual stream of water passing through the tubes to keep them cool. This is called injection water, and after passing through the tubes, passes overboard through the outboard delivery. The exhaust steam coming in contact with the cool surface of the tubes condenses and falls in the form of water to the bottom of the condenser. From there the water is picked up by what marine engineers are pleased to call the air pump, which is in reality a water pump, sometimes of the single-acting, bucket-plunger type. Any steam pump that will handle hot water can do duty as an air pump. The air pump delivers the water from the condenser to a vessel called the "hot" well, from which place the feed pump puts it into the boilers. When it is necessary to do so, to free the ship from water, the bilge injection valves are opened and the sea valves closed, using bilge water through the condensers.

I am surprised to find men at this late date, and who are working on marine engines, think that the air pump *does pump air*. I have told you that the exhaust steam condenses in the condenser; and what is the result? The condenser being entirely empty of everything there is a vacuum formed; and the nearer air-tight all joints are the nearer perfect the vacuum. You know that when a high-pressure engine exhausts into the atmosphere the air rushes into the cylinder and creates a pressure against the exhaust side of the piston, preventing the formation of vacuum. If for argument sake we call

atmosphere in pressure 15 pounds per square inch, then there must be that pressure on the exhaust side of the high-pressure piston when exhausting into the atmosphere. In the low pressure engine by forming a vacuum in the condenser, we gain 15 pounds on the steam side by removing or preventing the atmosphere having access to the exhaust side of the piston. If we were to change the name from air to vacuum pump it would be nearer the thing; as maintaining a good vacuum in the condenser a great deal depends on the good work of the air pump.

Railroads in their locomotive practice are not making the rapid strides in the working boiler pressure that obtains in modern marine practice. It may surprise some when I make the assertion that the pressure in marine boilers has jumped up 225 pounds per square inch; yet such is the fact, for 25 pounds per square inch on the old marine boilers was a whole lot of steam, and the writer has blistered his hands trying to hold 20 pounds. Yet the working pressure of the boilers of the new battleship, Maine, is 250 pounds per square inch, and no doubt that pressure is held by less hard work than under the old system; but the boilers are different.

W. DE SANNO.

Vallejo, Cal.

A Young Admirer of Locomotive Engineering.

I am a little boy thirteen years old. I am very interested in locomotives. I am acquainted with Mr. D. D. Briggs, master mechanic of the Louisville & Nashville Railroad, of this city. I am a poor boy, and the only son of my widowed mother. I thought if you had a few extra copies of LOCOMOTIVE ENGINEERING every month would you please send them to me. If I had the money to get it, I would, but I have not.

ROBERT E. LITTLE.

3643 Camp street, New Orleans, La.

[Of course, Robert, you can have what you ask for. You may be a celebrated engineer some day.—Ed.]

An Obscure Scenic Railroad.

As I have never seen anything in LOCOMOTIVE ENGINEERING in regard to the Buffalo & Susquehanna, I will send you a short description of it.

The motive power department is under the management of Mr. W. A. Brown, who has made some decided improvements in the shop equipment since his appointment. The car department and "cripple tracks" are equipped with air jacks. The paint shop does all plain painting with air, and the boiler and machine shops also have their quota of modern improvements. We think they will compare very well with other shops of the same size.

We have ten consolidated engines, ranging from 70 to 98 tons; four ten-wheelers, about 65 tons—all Baldwins except one, a Brooks—and five eight-wheelers, including the Holman.

In connection with the Buffalo & Susquehanna is the F. H. & C. W. Goodyear Lumber Company. They also have twelve Shay gear or Lima engines.

As a scenic route the Buffalo & Susquehanna cannot be beaten, and at some future date I will send some news descriptive of its curves, grades and switchbacks.

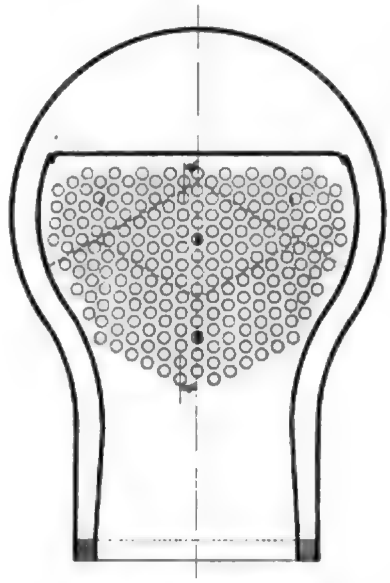
F. V. BALCH.

Galeton, Pa.

Peculiar Plan of Tube Setting.

As the subject of this article is likely to be of interest to many of your readers, I send you herewith sketch showing our method of laying out tube sheets and a description of our method of working tubes.

In working tubes we always roll all



PECULIAR PLAN OF TUBE SETTING.

tubes first, sectioning them afterwards. Starting at either of the sections marked 1 in sketch, we roll all the tubes in these sections, proceeding to section marked 2, and finishing the rolling with section marked 3. We then section them with the Prosser expander, taking the different sections marked 1, 2 and 3, in the order named, as in rolling them.

By this method we find the tubes in corners of section 1 are perfectly round after the work is done, instead of the old experience of finding them oval. We also find by rolling first and sectioning afterwards that the tubes remain tight about three times as long as when sectioned first and rolled afterwards. This we attribute to the fact that the roller does its proper share of the work, the tube being rolled tightly back against tube sheet before the section expander is used, and we only use it for its proper share of the work, viz.: the putting of a shoulder on the tube inside tube-sheet.

I have read quite a number of articles in which the writers have given their experiences of sheets going up as much as ¼ inch in some instances, in the process of rolling and sectioning, and the expanders have been blamed for the trouble, whereas I think the principal trouble is in the method of using the expander rather than in the tool itself. I have trammeled our sheets (before and after rolling and sectioning) from center at bottom to center at top and from center at bottom to extreme top corners, and the greatest difference shown after the work has been done was 1-64 inch. This is not sufficient to cause any trouble, and I think goes to show we have the correct method of working them. We have done our work in this way for about seven years, which should be a long enough time to prove the efficiency of the system.

You will notice from the sketch our method of laying out our tube-sheet holes. We lay them out with the centers wider at the bottom than at the top, and find we get better circulation than by the old system. I think the wider space at the bottom is very beneficial in preventing the accumulation of sediment, which is a prolific source of tube trouble. You will also notice we put the top of upper row of tubes 2 inches down from under side of crown sheet, and this 2 inches of metal above tubes forms a strong brace against the holes going oval in rolling and sectioning tubes, as also does the leaving out a hole in each of the top corners.

JOHN TONGE,
Master Mechanic.

Minneapolis, Minn.

Home Made Metallic Packing.

It has been said that the development of the American locomotive has largely been in the line of perfecting details, rather than changes in design. Among those who have labored to bring about the present high state of efficiency, and who will ever be remembered with a feeling of gratitude by locomotive engineers, is the genius who first successfully applied metallic piston rod and valve stem packing to locomotives. That there was need for something of the kind in the hard service to which locomotives are often subjected is quite clear, and the readiness with which mechanical superintendents take hold of a device of undoubted value is evidenced by the fact that of the 38,000 locomotives in service in this country at least 28,000 of them are fitted with metallic packing of some sort.

Many of your readers who were handling locomotives ten or twelve years ago, that were not equipped with a driver brake, well remember the task it was to keep valve stems and piston rods in such condition that a pilot bar coupling could be made with some degree of safety, and particularly so after valve and piston rod bushings had become worn. It was not unusual to have to pack a rod on the trip,

while the "screwing up" of glands was of frequent occurrence. Some of the fibrous packings in use at that time caused the rods to wear rapidly on account of the undue friction developed, while heating and consequent scoring of pistons was quite common on hilly roads where trains were allowed to coast, unless a small quantity of steam was passed through the cylinders to keep down the temperature of the rod. That this result should follow was to be expected, when we consider that each runner had his own individual idea as to what degree of tightness the packing should stand, together with the many different materials employed to provide against leakage. A few of the worst that I recall were old rubber hose, wet and partly rotted hemp, bell cord with rubber sleeve, petrified asbestos, etc. One great fault with most fibrous packings was that they failed to carry the weight of the stem, and the bushings soon became badly worn, and trouble began.

The first style of metallic packing with which the writer had to do, and used by a number of roads in the West, was one of the "male and female" type, and consisted of rings triangular in section—nearly; the babbitt rings being used next the stem or rod, while the soft lead rings made the joint next the stuffing-box; the wear of the rings was taken up by advancing the gland. Among the few objections to this type of packing are the following: Adjustment to wear being left to the judgment of enginemen, often resulting in its being too tightly screwed up—in an effort to stop leaks—causing rapid wear of the motion work; and heating and melting of the piston rod packing when drifting down hill. To avoid this latter tendency, and to some degree take up the wear automatically, a few roads applied small coil springs between the gland and the nuts. I have found, however, in my own experience with this style of valve-rod packing that a decided improvement resulted from the use of a rubber sleeve in a plain stuffing-box, with the metal packing next the stem; this in combination with the springs on the studs gave a somewhat flexible packing that appeared to adjust itself to the vertical movement of the valve rod, and would frequently run eight or ten months without attention other than an occasional tightening up and oiling. An undesirable feature of this style of packing as applied to piston rods was that it required crossheads to be almost free from lost motion to get the best results, and avoid undue strains on the crosshead fit. Again, if a rod of smaller diameter was used in the same stuffing-box it required thicker packings in order to fill out, and a size of ring was soon reached that did not yield readily to the screwing process. Carefully applied, kept well lubricated, and under the care of an attentive engineer, this packing gave very good results, and was a decided improvement over the fibrous packings used previously; it has largely given way, however, to the more mechanically correct packings that automatically take up wear and utilize the pressure packed against, to make the joint on the rods, and which will form the subject for another letter.

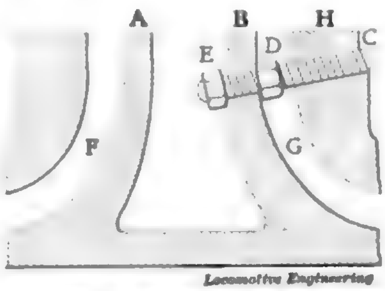
C. P. Cass.

Monett, Mo.

Strengthening a Cracked Bridge.

One lot of locomotives purchased some years ago by a well-known railroad company, developed, after a comparatively short period of service, an unexpected weakness in the cylinders.

They were designed for freight service, and were of a, then, heavy consolidation type, with 20 by 24-inch cylinders. The latter, in the endeavor to make the weight



PATCHING A BROKEN CYLINDER BRIDGE.

on the leading truck as light as possible, were as thin as consistent with strength and durability.

The designer, in his effort, neglected to provide proper stays for the bridges between the steam and exhaust ports, and as a consequence they soon cracked at or near the inner corner of the port.

The area of the section exposed is fully as much or more than 120 square inches, and this multiplied by 90 per cent. of a boiler presure of 160 pounds to the square inch, gives a total pressure not far from 17,000 pounds tending to force the bridge into the exhaust cavity.

The constant vibration, while working, consequent to the change at every stroke from the maximum pressure down to almost nothing, greatly increases the liability to fracture, and it was not long after a bridge cracked at the corner that, if not repaired, it gave way entirely and ruined the cylinder.

The scheme of drilling and tapping a hole through from the steam inlet and putting in a threaded staybolt was tried, with fair success; but the vibration by wearing out the threads in the thin section of cast iron of the bridge soon loosened the bolts and rendered them useless.

Finally, the simple method shown in the sketch for preventing this was suggested and adopted, and has proven so far a success.

As shown, it simply consists of the staybolt *C* and the chamfered nuts *E* and *D* on each side of the bridge *B*. These, when backed up tight against the bridge, hold the bolt from working loose, and also present enough surface to insure durability. The thicker wall of *H* gives thread enough, so that the jam nuts are unnecessary.

If by any chance the nut *E* should work off, it can do no harm, as it will be blown out with the exhaust, and it is next to impossible for *D* to become detached.

Fred E. Rogers.

Corning, N. Y.

Rules for Calculating Traction Power.

In January, 1899, number of your most valuable paper, while calculating the tractive power of a locomotive, in your second rule you use the area of piston multiplied by mean average pressure of steam, the result of which I fully understand to be the aggregate or total power exerted on piston and the same transmitted to crank pin. In first rule you use the square of the diameter of piston multiplied by mean effective pressure. It seems to me there is more total pressure represented here than there actually is. Will you please explain why the square of diameter is used in the one rule and the area in another?

H. G. Alvord.

[The first rule is an abreviated method. If you figure the area of both pistons, length of stroke and steam pressure, dividing by diameter of drivers, the result would be the same as what it is by the shorter method.—Ed.]

Smokeless Firing—A Reminiscence.

Reading of the methods pursued on the Burlington, Cedar Rapids & Northern Railroad and the results obtained, reminds me of the old Boston & Providence road under "old man Griggs," as the boys called him. He had the "one shovel at a time idea," and worked it to extremes.

I don't remember so much as to the smoke; we were not bothered by smoke laws in those days; but he went so far as to regulate the amount of coal to be thrown on at each shovelful. He found a fireman would take a shovel full anyhow, so all new shovels went to the blacksmith shop first and had about four inches cut off from the end of the scoop. This abbreviation the boys called "taking the lead off" the shovels, and he practiced it for some time.

This recalls a cranky engineer in the days of the old wood-burners, who had an over ambitious fireman. The fireman seemed to take pride in being able to keep the firebox packed full of wood at all times, whether it was needed or not, and instead of explaining the "whys" of the case to the youngster, the engineer gave him an object lesson.

They had got the train rolling nicely, and the fireman started to pile in more wood. "Heave that stick out on the

ground," commanded the engineer, and out it went. This was repeated until he had thrown out a dozen. "Put the next three in the firebox," was the next order, and the fireman began to think he was riding with a lunatic. This performance occurred several times during the trip, and finally the fireman demanded an explanation.

"Well, son," said the engineer, "the fire didn't need no more wood them times, so I had you fire the wood out where the company could find it; if it had gone in the firebox, they never would." The fireman learned his lesson, but he thought thinks that were not all complimentary to the engineer. R. E. MARKS.

Camden, N. J.

Engine Failures.

What are the causes of some "engine failures," which seem to be more frequent in extreme cold weather than when it is milder?

With locomotives in good order—that is, no waste of steam by reason of cylinder packing or valves blowing, draught appliances correctly arranged—being run and fired properly, then if they do not "steam," where shall we look for the trouble?

A question arises here: When no good reason can be seen why the pressure should not be maintained, is it that, in some instances, the boiler is being drained beyond its steam-producing capacity, to meet the demands upon it? Without doubt, a large majority of firemen, particularly those upon fast trains, understand the principles of coal combustion in locomotive fireboxes. They may not be able to tell the names of the different gases, but, as a rule, they do know when a fire is burning with a clear white flame, so incandescent that only experienced eyes can see through it to note its further needs.

On many large roads at the present time trains are composed of from six to ten or more cars, with perhaps several of them "Wagners" (which many of us know "do not run alone," especially up the grades), which at this time of year make a continual and ever-increasing demand upon the boiler to heat them properly; 30 to 50, and sometimes 60, pounds of steam heat being carried.

With exceedingly fine coal and this oftentimes excessive drain upon the boiler, fast time to be made, much of it over heavy grades, make it a difficult matter even for a skillful fireman to properly maintain the fire in condition under the requirements of our modern train service. The steam gradually falls 10, 20, 40 pounds, and perhaps lower; time is lost and an engine failure recorded. Should the failures be charged up against the engine, when apparently it is a combination of circumstances brought about by the conditions surrounding it, in which the engine is only one factor? What are some of the factors?

1st. The writer has seen flue-sheets where as many as one-third of the flues were plugged solidly. Coal should lie upon the grates and be consumed in the firebox, but we know that it is sometimes carried into the flues when the engine is worked to its maximum capacity.

2d. Has the grate area been increased of late years in the same ratio as the increase in gross tons of train-load and the

JOURNAL TURNING DEVICE.

quicker time schedules that are in force?

3d. How much of this drain upon the steaming capacity can be charged to what is required to operate injectors? Can the amount taken be measured? If it could be, we might be surprised.

4th. Is the quality of the coal such as would leave nothing to be desired in this respect. Is not the service, with all its limitations and requirements, entitled to the best grades of coal in order to meet the conditions of modern train service as it exists to-day upon roads in northern latitudes? J. W. CHAMBERLAIN.

Boston, Mass.

[Our correspondent is in error in his remarks about the steam needed to operate injectors. If the injectors are properly located and the piping so arranged as to give the best results, an injector can be operated at as low expense for power supplied by the boiler as a pump.—Ed.]

Car Journal Turner.

I send you under separate cover, blueprint of car-journal turner. This tool was designed and built at the Clinton, Chicago & Northwestern Railway shops, under the management of Mr. Joseph Cockfield, master mechanic. This tool is run by an air motor and does very rapid and accurate work. It is adjustable to all diameters and lengths of journals. You will see by photograph that it is applied to wheel under car, which is a big saving in time. Before this tool was built all journals that were cut or worn had to be taken out and put in lathe. As there was only one lathe in shop to do this work on, and it always was busy on other large work, there were many delays which led to the making of this tool. You will see by photograph emery-wheel on air motor to grind tools with. CHAS. MARKEL.

Clinton, Ia.

End of the Holman Monstrosity.

Noticing in a late issue of LOCOMOTIVE ENGINEERING a cut of the Holman engine, I think it would be of interest to your readers to know that she is in active passenger service on the Buffalo & Susquehanna Railroad, minus her Holman trucks, which makes a plain simple engine of her. Her fancy parts are in the scrap heap at Baldwin's. As she is now she gives very good satisfaction. F. V. BALCH.

Galeton, Pa.

Several letters are left out for want of room.

A steam boiler that will evaporate more than 10 or 12 pounds of water to the pound of coal is not often met with, but they have in the navy evaporating machines which seem to have extraordinary efficiency. A paragraph in the report of the Chief of the Bureau of Steam Engineering, recommending the use of distilling ships for the navy, says: "A multiple-effect evaporating machine which would be able to give more than 20 pounds of fresh water for each pound of coal burned in the boilers evidently was the most satisfactory solution of the question, as a vessel with such apparatus of 50,000 or 60,000 gallons per diem, and with a coal capacity of, say, 3,000 tons, would be able to supply an amount of water equal to a large number of tank vessels. Such a vessel would also have the further advantage that she is practically a collier at the same time, and should there be an emergency in which coal was needed more than water, her large supply of coal could be utilized for that purpose instead of distilling."

Locomotive Engineering

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Tests of Boiler Covering.

It is a long time ago since we were forcibly impressed with the fact that in northern latitudes locomotives burned a great deal more coal in winter than they did in summer, and that during the cold season restricting of exhaust nozzles had to be practiced to enable the engines to haul their trains on time. There were a variety of reasons given among practical enginemen to account for this undesirable state of affairs, which mostly turned upon the effect that the cold wind had upon the draft and upon the resistance of the train. To us that did not account for the difficulty in keeping up steam. We formed a theory that the shortness of steam resulted from the boiler being robbed by the cold wind of a great part of the steam generated, the wind acting as a condenser to turn a considerable part of the evaporated steam back into water.

While living in Chicago a good many years ago, we succeeded in interesting a superintendent of motive power, of one of the leading railroads with headquarters in that city, to put at our disposal a locomotive with boiler covering of the usual loose wooden lagging for experimental purposes. The engine was put on an exposed side track when a bitterly cold wind was blowing, and tests were made to find out how much coal per hour was consumed in keeping the steam up to a pressure of 140 pounds gage pressure. The quantity of coal consumed in keeping up the loss to outside condensation convinced us that a good non-conducting boiler covering was one of the most profitable improvements that a railroad company could invest in. The tests made were somewhat crude, but withal they were very convincing, and since that time we have never ceased to advocate a better class of boiler covering than the inefficient pine board which becomes a seive for the admission of cold air as soon as the heat of the boiler sheets effects its work in shrinking the wood.

We are therefore gratified to learn that the enterprising mechanical department of the Chicago & Northwestern Railway have recently made very exhaustive tests to ascertain the saving of heat effected by a well lagged boiler, as compared with one that was bare, and that they have had no less a mechanical expert than Professor Goss, of Purdue University, to aid them in the work. The results of the tests have been described in a paper presented to the Western Railway Club by Mr. Robert Quayle, superintendent of motive power of the railway named, and facts presented are of the utmost importance to railway companies. The plan adopted was to supply an experimental locomotive with steam from another one, the experimental locomotive being entirely dependent upon the other for all the steam conveyed to the boiler. Then careful records were made of the weight of water condensed per minute. That, of course, would show how much heat was required to compensate for the radiation of heat due to the exposed surfaces of the boiler under test.

The tests were made in the month of August, a bad season for indicating the extent of heat losses due to radiation, but it was easy, by calculation, to reach an approximation of what the losses would be at freezing temperatures. One set of tests was made with the boiler at rest, and others while it was pushed forward at a speed of twenty-eight miles an hour.

Under the standing test, the uncovered boiler lost 6.78 pounds of steam per minute, which was more than three times the average loss from covered boilers. At a speed of twenty-eight miles per hour the average loss from uncovered boilers was 14.27 pounds of steam per minute as against about 5.5 for a covered boiler. Owing to commercial considerations the names of the different boiler coverings employed were given by letters which defy identification, but there is a very decided difference in the efficiency which railway companies ought to be informed about.

We are not informed what was done to indicate the shortcomings of wooden lagging that had shrunk until the air of heaven could circulate freely between its pine boards and the boiler sheets. If the air currents impinged at the angle which would pour currents to the best advantage under the boiler jacket amidst wooden laggings, we are persuaded that there would be very little difference between that form of boiler covering and the bare boiler. With a boiler that had only 61 per cent. covered by insulating covering the saving in loss of heat was 62 per cent. of that due to an uncovered boiler. The report does not enable us to estimate what the saving in dollars and cents is likely to be due to the use of good insulating covering for locomotive boilers, but it leads us to the conclusion that it would be difficult to find a line of improvement in locomotive details of maintenance or construction where better results in the way of economy could be obtained than those arising from well-covered locomotive boilers.

Another lesson to be learned from the tests is, that more than 61 per cent. of the exposed surface of boiler and firebox ought to be covered. A large uncovered area is the front and sides of the firebox. These flat surfaces give the wind a good hold and must cause serious loss of heat. A few railroad companies cover these surfaces and experience no great difficulty in keeping the lagging in place.

Tonnage Rating for Locomotives.

The tonnage rating for locomotives has come to stay. So far as known, no one who has given it a fair trial has abandoned it. As they found difficulties in the way of its success, they have gone resolutely at work to see how the trouble could be remedied.

What is now necessary is for the roads to get together, so that the weight of a car, whether loaded full, partly loaded or an empty, will be so stated that there can be no confusion in the minds of the men making up the trains.

No matter how carefully devised any system of tonnage rating may be, the final execution of it must be left to the yard master who makes up a train at a terminal point, or the conductor who fills out at local stations. If the system is complicated, he will guess at the weights, instead of figuring them up closely, so as to get the exact amount needed for a full train. If less than a full train is taken, it is a loss to the railroad company; if too much is taken, the train makes poor time at stations, as well as between stations or stalls on the hills. Therefore to be a success some attention should be paid to the ease and certainty of the making computations by the trainmen.

If the loaded cars have all been weighed and the correct gross weights marked on the way-bills, this computation is easily made; but when one road uses the net weight of load and another the gross weight of car and contents, it makes trouble at interchange points. Then the various methods of rating empties, cars partly loaded and merchandise cars is a stumbling block.

It is now pretty well understood that we cannot draw as many tons of empties,

by actual weight, as of heavy loads, but the proportion is not yet accurately defined.

The matter of an allowance for the manure and bedding left in stock cars should receive close attention; it will probably develop that it costs less to clean out stock cars at terminal points after unloading in the East than to haul the extra load back to the loading points in the far West.

Where actual tests have been made to determine the proper load by pulling trains of a known weight over the hills, variations have been found on account of different conditions of rail and weather, that have not always been worked out to a clear solution. This is a matter of a good deal of importance, and it is hoped that before long someone will hit on the right way to allow for it. Making a lower tonnage for a lower temperature does very well, but the direction and force of the wind makes as much difference as colder weather.

Nothing but careful dynamometer tests will determine this factor with any certainty. A cross wind that catches the corner of every car in the train and induces extra flange friction is much worse than a head wind. In the case of empty gondolas the rating should come between that of box cars and of flats. Some engineers say that a gondola pulls harder than an empty box car. The rating should be devised so that it can be used for trains made up of heavy loads, light loads, merchandise cars and the various kinds of empties in one train. More than half the roads in this country pull that kind of a train.

The matter of excessive friction on side bearings of cars is important. A few loaded cars with weak bolsters, allowing the weight on side bearings instead of having the center bearing take its proper share, will hang back on curves on account of the flange friction almost as bad as if the brakes were set. The tests made by Mr. A. M. Waitt by setting cars on a sharp curve with a down grade showed that the cars with the weight on side bearings would not curve easily enough, or even right the trucks around square after getting on straight track, to run down hill alone; while the cars with weight carried on center bearings would run around the curve almost as easily as on straight track.

The expense of making careful tests with a dynamometer car on every hill on the road, under varying conditions, will be more than repaid by the closer rating which can be given the locomotives and get the trains over the road in good time. An addition of 1 or 2 per cent. to the load can be made under certain conditions with no loss of time in transit. That 2 per cent. contains just as much profit as any other 2 per cent. of the train. This is the time to take account of small profits. If the civil and mechanical engineers who figure out the ratings will insist on making pulling tests with a dynamometer car to prove their calculations, as well as to establish the relations between the varying conditions and the proper tonnage, and spread the knowledge thus gained where all can see it, through the technical journals, it will be an important addition to the stock of general information on this subject. Success will be gained by a general interchange of ideas and results of actual tests.

A Vicious Pound of Flesh.

A wave of agitation is passing over the railroad world that urges improved methods of firing locomotives, and it seems to us that the men who are in the best position to carry out this much-desired reform have displayed decided willingness to do the best in their power to make a pound of coal perform its highest possible efficiency in steam making. The railroad companies, as a rule, who are agitating the burning of soft coal without smoke are meeting with the cordial co-operation of all the most intelligent and progressive enginemen in their employ. Burning coal without smoke means important reductions in the fuel bills, and reduced expense of repairs to boilers and all their attachments. This important result being admitted as true, it is well to propose that railroad companies should make some effort to give back something of an equivalent to the enginemen, for the increase of labor and attention they are willing to devote to the better performance of their duties.

Ever since the first locomotive turned a wheel, there has been a steady tendency towards heavier and more powerful engines, but this tendency has never been so pronounced as it has been on the American continent within the last ten years. Twenty years ago the most common size of locomotive was 17 x 24-inch cylinder, and capable of exerting about 13,000 pounds tractive power; to-day the prevailing size has cylinders 20 x 26 inches at least, and has a hauling capacity of about 28,000 pounds. The power of the engine has been more than doubled, the labor of operating has been increased in proportion to the greater power, and yet the enginemen are required to do as much extra labor as was required of them when the locomotives were small.

The practice of using metallic packing has relieved the engineer on many roads from the arduous labor of packing glands; but nothing has been done to relieve the fireman from the labor of cleaning and scouring all parts above the running board, which is a traditional inheritance. When locomotives were small, when all engines were kept on regular runs, and when the mileage made was comparatively short, it was no great hardship to require the fireman to keep the cab equipment well polished and the boiler jacket shining; but with modern conditions, adding these requirements upon the fireman overworked as he is, is an intolerable burden. This burden is imposed very often by thoughtlessness on the part of the officials, and it leads to hard feelings between employers and employed that costs the former ten times what the outlay would be to employ cheap labor to do the work.

We do not know of any railroad in the world where there is so much genuine loyalty towards the company on the part of the enginemen, as there is on the Nashville, Chattanooga & St. Louis, and there is no railroad in the country where the operating expenses of locomotives are lower. Yet there is a standing rule on that road, that engineers and firemen are not permitted to go to the engine house. They leave their engines at the termini, and do not go near them until they go to the station to start on their next trip. The enginemen have no more responsibility for keeping the locomotive clean and in working order than the conductors and brakemen have in regard to cars. And they ought not to have more responsibility. The work of inspecting, packing and polishing is done by experts on inspection and cheap labor for cleaning employed by the company. The general manager of that company has been a fireman and locomotive engineer himself, and he understands the treatment necessary to keep that hard-worked class of men in the humor that brings forth their best efforts for the interests of the company they serve.

On many roads it is quite absurd the demands put upon enginemen in the care of the locomotives they have made a trip upon. Engineers who do not expect to make two trips on the same engine in a month are held responsible for reports being made of all defects requiring attention and that of machines having strata of grease and dirt on every part that has remained unbroken for months. These same engines that are never wiped under the running board from the day they leave the back shop until they return to it, are supposed to be kept clean in the upper stories by the overworked fireman, whose periods of rest must be broken by labors that make the contrast between the foulness of the lower parts and the sheen of the upper parts of the locomotive something that lovers of cleanliness are ashamed of. We have always believed that the practice of running locomotives without wiping was one of the dearest and worst directed efforts at cheapness which railroads ever indulged in; but we think that compelling the overworked fireman to devote hard labor on the cleaning of the upper parts of the engine, when the really important motion is left untouched, is merely intimating that the employers will insist on taking the pound of flesh that too long continued custom has led them to believe was theirs by right. Loyalty to an employer is based on a sense of justice. A set of disloyal enginemen

is an expensive condition that no railway company can afford to maintain.

How Oil May be Wasted.

One of the principal troubles met when dealing with the question of oil economy on locomotives is largely out of the hands of the engineers to remedy. If the condition of the feeders in the rod cups and on the guides is such that the amount fed through cannot be regulated very closely to the actual needs of the bearing, it will exceed the limit allowed.

Where a plunger feeder is used in the rod cups the tendency is for the iron pin to wear the hole through the bottom of cup oval, and they also wear tapering, smallest at the bottom. The pins or plungers also wear out of truth; when in one position they are so loose that they feed too fast, and with a quarter turn in the cup they may stick and not feed at all. These holes should be as near straight and round as it is possible to make them.

One method of making a feeder for a rod cup that can be varied to suit the different conditions of weather and the needs of the bearing, is to have the pin or plunger double ended with a collar in the middle. One end of the feeder is a neat fit for the hole in cup, so it will feed slowly; the other is a shade smaller in diameter; it will feed faster. Either end can be used as desired. Guide cups should always be covered to keep out dirt and cinders, those which have screw feeds need particular attention. Where there is much spring to the guides or pound in the crosshead, these cups shut off entirely. To allow for this, they are set at the beginning of the trip to feed more than necessary. If they are run without covers, dirt and cinders work in, which interfere with their accuracy.

The chokes or nozzles in sight-feed lubricators, if worn or enlarged, can waste valve oil to a greater extent than is generally credited. If set at three or four drops a minute when working steam, they may feed three times that amount when the engine is shut off. On a road that is up and down hill this cuts quite a figure. Besides, the excess of oil that is fed when the engine is standing still is practically wasted.

The steam supply pipe from the turret to the top of lubricator should be of ample size; a contracted steam pipe will stop the feed of oil altogether for an instant when the throttle is opened. If the oil feeds are being set at this time, they will be open too wide at other times.

To secure good results from the use of supplies, the machine using them must be in good condition.

We would suggest that this matter be given close attention by all interested. They will be fully repaid for the expense of inspection and repairs by increased mileage per pint of oil.

"Engineer" and "Electrician."

There are certain classes of so-called professional men who claim the right to use a certain title that are always worrying themselves because the world accords to others the same title when they, the other fellows, have no documentary evidence to produce for their right to share a name considered an honor to bear. Certain diploma-burdened engineers have been terribly harrassed because the man who controls the destinies of a stationary engine in an evil-smelling cellar has, by popular voice, the title of engineer; and no small amount of mental energy has been wasted in teaching the popular voice the evil of its ways. But reform goes slowly among irresponsible people, and we are afraid that the diploma engineer will have to go on enduring the torture of hearing plug pullers and scoop operators termed engineers.

Now a new cause of dispute has arisen on the question of a technical title. It has become customary to call all the men electricians who possess skill or knowledge concerning electrical apparatus. Now *The Purdue Exponent* thus expounds the Simon-pure electrician:

"Linemen, bell fitters, motormen, lamp trimmers and dynamo tenders cannot properly, as a rule, be classed as 'electricians.' An electrician is a person who is well versed in the laws of electro-magnetism in addition to having a good practical training in the use of electrical appliances. He will usually be found in the position of a designer of electrical machinery, the directing engineer of a city electric light or electric street railway plant, the engineer of a department of a manufactory of electrical machinery, a consulting electrical engineer, or an electrical engineer holding a position in a college faculty. Our latter day American electricians are usually college graduates in electrical engineering who have supplemented their college training with good practical work in commercial electrical engineering."

Kansas Law Against Railroads.

When we read about the doings of the Populist Legislature of Kansas, we often wonder if organized labor has lost its voice and its influence in that State. When anything is done to seriously damage the earning power of a corporation such as a railway company, it is the employé that the burden eventually falls upon.

It looks to us as if the Kansas Populists have attempted to ruin the railroad labor of that State. In the expiring days of the last Legislature, a bill was passed establishing a Court of Visitation, whose duties are principally that of interfering with railroad managing. It creates a lot of high-paid officials, and the Court is clothed with powers to try and determine all questions as to "what are reasonable freight rates; to apportion charges between connecting roads; to classify freight; to apportion transportation charges among connecting carriers; to require the construction and maintenance of depots, side tracks, etc.; to compel reasonable train and car service; to regulate crossings; to prescribe rules concerning the movement of trains; to require the use of improved appliances and methods; to restrict railroads and the powers named in their charters to summon jurors."

Experienced railroad managers have found it very difficult to perform all these duties, and yet the "hay-seed" legislators are prepared to put into office men with no railroad experience whatever, to teach something they are entirely ignorant about.

In case of a strike on a railroad, the court may take up the case and compel the railroad to explain its position, telling wherein the acts of the employer led to the strike. If the court finds that the road is free from fault, it shall be unlawful for the strikers thereafter to interfere by word or deed with new men employed by the road; but if the court shall find that the road has failed in its duty or has been tyrannical, oppressive or unjust, and the strike resulted therefrom, it shall command the road to perform its usual functions; then, if the road does not obey, the court may take charge of its property and appoint a receiver.

If a railroad neglects to obey an order of the court, the court may order the sequestration of its property and appoint a receiver to take possession of it.

BOOK NOTICES.

"Transactions of the American Society of Mechanical Engineers," Vol. XIX, 1898. Published by the Society.

This is a volume of 1,033 pages which we annually receive through the courtesy of Secretary Hutton. This year's "Transactions" contain a great many useful papers on engineering and industrial topics and also discussions thereon. The series form a very valuable library of reference for engineering writers.

"Repairs of Railway Car Equipment." By H. M. Perry, M. C. B. Published by the *Railway Age*, Chicago.

A very attractive book of 172 pages, containing the cost, in detail, of all the parts used in the construction of coaches and cars, as well as the cost for repairs of any part. There is also a large amount of information on other subjects, which is tabulated and indexed, so it is a ready reference for all railway officials.

"Quick and Easy Methods of Calculating. A Simple Explanation of the Theory and Use of the Slide Rule, Logarithms, etc., with Numerous Examples Worked Out." By Robert Gordon Baine, M. E. London: E. & F. N. Spon, Ltd., 125 Strand. New York. Spon & Chamberlain, 12 Cortlandt street. 1898. $1.00.

The caption explains fully the objects of this work of 138 pages, but without a

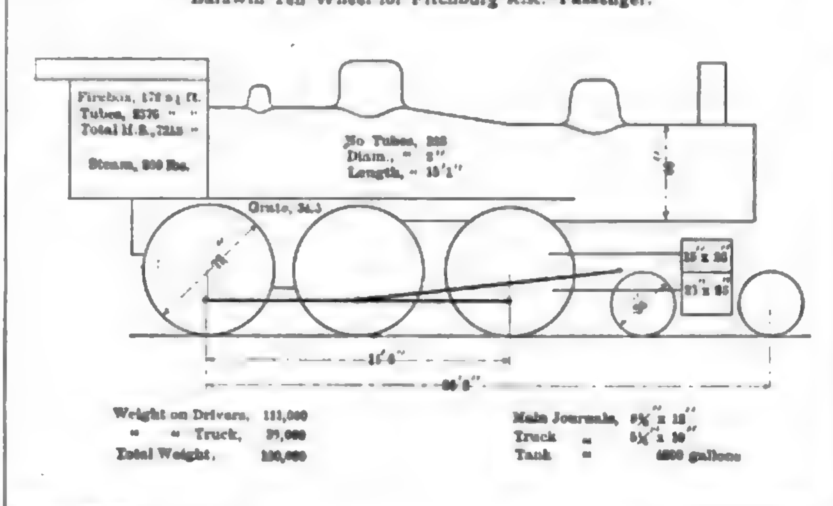
few words concerning the easy steps leading up to an understanding of logarithms and the slide rule as far as actually necessary for practical use, the actual value of the book would not be apparent. Short-cuts in calculation familiar only to the expert mathematician; how to use tables of logarithms; how to find the reciprocal of a number; powers and roots; reduction and conversion of one quantity to terms of another, all solved by practical examples on the slide rule; survey plotting; laws of falling bodies; kinetic energy; hydraulic problems; technics of electricity; the principle of moments, are a few of the subjects brought within the scope of the slide rule. The simple and concise style of the author makes the work a valuable one to the beginner as well as to the busy engineer. The book is bound in leather, with gold inscriptions, and is 4¼ x 6½ inches, a size convenient for the pocket, but one not conforming to any of our standards.

In its recently submitted report to the Legislature, the New York State Railroad Commission recommends the employment of an additional man on each locomotive engine of the Wootten firebox or "Mother Hubbard" type, or some other practical device which shall furnish communication at all times between the engineer and fireman. This particular type of engine, on account of its peculiar construction, isolates the engineer from the fireman, and frequently the two do not see each other for miles. During the past few years there have been instances where the engineer was killed or died suddenly at his post, and the train ran uncontrolled until the dead engineer was discovered by the fireman. The Commission seeks to avoid possible disaster in such perilous, though infrequent, instances.

We sympathize with the complaint made by Mr. Tracy Lyon in our Correspondence Department, in which he wishes our readers to know that it was not on the Chicago Great Western Railway that a case of heinous wheel fitting took place, which was described on page 7 of our January number. Had we entertained the least suspicion that our readers would mistake the Chicago Great Western for the Great Western of England, we should have mentioned the country where the railway was. The rule we follow in mentioning railways in foreign countries is to name the country if there is a railway of the same name in this country. For instance, we always say the Great Northern of England, because it might be mistaken for Mr. Hill's great property of this country.

Malleable iron and soft steel castings are coming so much into use for railroad work that we are every month reading reports that certain railroad companies are about to establish plants to make these kinds of castings for themselves in order to save the manufacturer's profit. To those considering this line of enterprise we would say "don't." Both lines of work require special skill which can only be attained or employed in foundries with a large output. Sensible railroad managers confine their mechanical operations to the repairing of locomotives and cars. When manufacturing operations on a larger scale are attempted it always results in increasing the cost of keeping the rolling stock in running order. The failures that have followed every attempt at branching into the line of manufacture ought to be object lessons enough to point to the path of safety.

A letter from Mr. P. E. Stellwagen in our Correspondence Department, relating to railroading in Africa, gives a very striking idea of the tremendous difficulties that stand in the way of trains on some parts of the dark continent. They have a fly there whose sting is fatal to horses and cattle, and the fly is very numerous in some places. Rindepest seems to be a prevalent disease among cattle, and cleans out whole districts at a time. Railroad men have their own troubles with the native animals, for it is no uncommon thing for men who go out flagging to get eaten up by lions or other wild beasts before they get back to their trains. Then a festive rhinoceros comes along occasionally and sends the section gang shinning up telegraph poles, or a band of unruly elephants come trumpeting through station yards, frightening the switching hands as the threats of no yardmaster ever did. Verily Africa is an exciting continent to railroad on.



Baldwin Ten Wheel for Fitchburg R.R.—Passenger.

Engine Diagram *Locomotive Engineering*

Children Cry For It.

One of our New England friends writes us that his little grandson, less than three years old, is so fascinated with the "engine book" that he calls for the paper every time he goes to see grandpa. Then he looks over the paper and comments on the engines and illustrations. He evidently knows a good thing when he sees it, even if he is a youngster. May he have the same feeling when he grows up and join the ranks of the faithful.

Part 14 of J. G. A. Meyers' "Easy Lessons in Mechanical Drawing and Machine Design" has appeared, and has several points of special interest to railway mechanics. It tells of lining tender truck brasses, laying out boiler work, and shows the connection between the firebox and barrel of a boiler, also laying out a sheet to connect a round and a rectangular pipe. The parabola and hyperbola and their uses are shown, while the practical exercises include pillow blocks, lubrication, size of journals, line shafts, etc., etc. It is published by the Arnold Publishing House, 16 Thomas street, at 50 cents a part.

A great company has been formed within the month, with a reputed capital of millions of dollars, for the purpose of building and running compressed air trucks and road vehicles in New York City. Mr. W. J. Fransioli, general manager of the Manhattan Railway Company, has resigned to give his services to this company. There are a great many highly influential people connected with this new organization, and we have no doubt that they will do a great deal to push the auto-trucks into popularity, but we would not like to invest our hard-earned dollars in a company that has so little behind it to entitle it to be capitalized into millions.

Nearly all locomotives used for passenger-train service on the railways on the continent of Europe have automatic speed indicators. The officials do not have confidence in the judgment of the engineer to guard against running at excessive speeds.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(16) Learner, Springfield, Mass., asks:

Which is the front end of a stationary steam engine cylinder and of a locomotive cylinder? A.—The front end of a stationary cylinder is that nearest the guides; the front end of a locomotive cylinder is farthest from the guides.

(17) F. H. B., Brandon, Vt., writes:

In your answer to question No. 4 in the January issue you give the area of a ½-inch pipe as .304 of a square inch. I figure it to be .19635 of a square inch. Where is the difference? A.—The difference is due to the fact that the actual inside diameter of a ½-inch pipe is more than a ½ inch. The standard tables give it as .622 of an inch, instead of .5. This makes the area .304 instead of .19635 square inch, as you make it.

(18) L. H. S., Brooklyn, N. Y., writes.

I had a discussion a few days ago with some brother engineers in regard to steam. I made the statement that steam is a gas, but they did not agree with me, saying that it is a vapor. We decided to refer the matter to you for settlement. A.—A gas is defined as a rarefied elastic fluid, and that is a good definition of steam. The technical world holds steam to be a gas. Vapor is defined as visible floating moisture, which steam certainly is not until it is partly condensed.

(19) B. L. T., Port Jervis, N. Y., asks:

When my engine went in the back shop she would handle the train in the 6-inch notch of the quadrant, but now she is out new, she will not do it above the 10-inch notch. Why is this? A.—It may be possible that taking up the lost motion in the bottom end of reverse lever in the reach-rod connections and tumbling-shaft bearings has raised the links up so that she cuts off shorter than before being overhauled. Taking off the lead on the backing eccentrics will also reduce the port opening of the valve when near mid-gear. It affects the travel of the valve so as to shorten the port opening. It will not affect the travel of the valve in full stroke.

(20) M. A., Susquehanna, N. Y., writes:

I have frequently seen mention of the Le Chatelier brake. Can you give me particulars about it? A.—The Chatelier brake is known in our mountain regions as the water brake. It acts by the locomotive being reversed, and consists of a jet of water admitted to the exhaust passages to prevent the suction of hot air and cinders from the smokebox. Only so much water is admitted to the cylinders as can expand into steam, which forms an elastic cushion for the piston when moving against the steam chest pressure. Le is superfluous in the name, as it is merely the French article "the."

(21) T. L. B., Columbia, S. C., asks:

Will you have the kindness to let me know the rules for counterbalancing locomotive driving wheels adopted by the American Railway Master Mechanics' Association? A.—First, divide the total weight of the engine by 400, subtract the quotient from the weight of the reciprocating parts on one side, including the front end of the main rod; second, distribute the remainder equally among all driving wheels on one side, adding to it the weight of the revolving parts for each wheel on that side. The sum for each wheel, if placed at a distance from the driving wheel center equal to the length of the crank, or a proportionally less weight if at a greater distance, will be the counterbalance required.

(22) A. M. G., Fort Plain, Iowa, asks:

Is it actually necessary to place the engine on the exact center on the disabled side in order to set a slipped eccentric? In some cases it is a hard matter to move the engine to that position after she is stopped. A.—No, it is not, provided you are able to replace the eccentric to its proper position using the other eccentrics as a guide. A good many bright locomotive men have got the proper position of an eccentric and its relation to the crank pin on that side so well fixed in their mind that they "set it by the pin." Others set the slipped one by its relation to the other eccentric on that side. If both of them are slipped the ones on the other side of the engine can be used. A full explanation of how this is done is too long for this column.

(23) Inquirer, Lowell, Mass., writes:

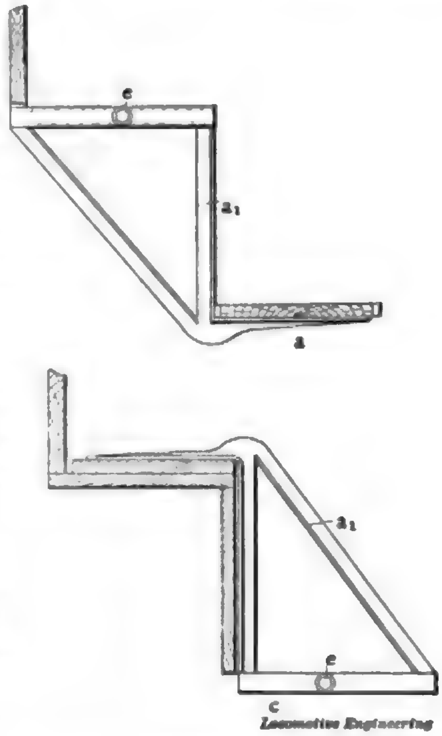
1. How hot would you dare to heat the water in the tank for Sellers 1876 self-adjusting style of injectors, which are set about 15 inches above the tank injectors in good order? A.—1. The Sellers 1876 self-adjusting injector will not handle water under these conditions at much over 100 degrees. The 1887 style will work water as hot as 125 degrees, but not with high steam pressures. As a rule, a low pressure of steam will handle feed water of a higher temperature than a high pressure of steam. 2. Is an engine which usually runs ahead more likely to heat if run backward quite a distance, than one which is run backward and forward regularly, if journals are properly packed. If so, why? A.—2. When an engine is run forward only, the packing in the cellars accommodates itself to that motion. If this motion is reversed the packing is liable to roll up the other way and get hot. Then more dust gets on the journals when backing up than when going ahead regularly.

Mr. Henry L. Leach informs us that in 1898 he had orders for 2,188 sets of his sanders, and that of this number 75 per cent. were his new type "D."

Folding Car Step.

The folding car step here shown has been patented by F. P. Darte, of Bangor, Pa.

By referring to the print you will see that *a* is the position of step when down or unfolded for use; a^1 is steel or iron frame; *e* is point of suspension tilting; *c* is position of step when folded. When in this position it is the same as an ordinary car step; is no more in the way, and can be used as such at stations where no stools or steps are used. When in this position it is held from tilting down by a catch.



FOLDING CAR STEP.

Dr. William Estes, of Muncie, Ind., has perfected and patented what he calls "a day and sleeping passenger car." The device permits of an ordinary day coach being converted into a sleeper, and restored to its normal condition for day travelers. The Pullman Company is about to test it. The Wagner Company is said to be also interested in determining whether it is practicable, and the Big Four is credited with having made a bid for the purchase of the patent.

The Falls Hollow Staybolt Company, Cuyahoga Falls, O., have just received a large order for safety staybolts from one of the leading ship and engine building companies of Philadelphia. The modern boilermakers are getting to appreciate the value of hollow staybolts rolled from good iron.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

The Old-Time Brakeman.

A Pennsylvania brakeman at Jersey City writes boxer McCoy, urging him to exercise on a hand brake of a passenger car, as this would develop the muscles of the legs, arms and back. It is said that the boxer has the suggestion for this special form of exercise under serious consideration.

There is doubtless much good in the suggestion, which calls to mind the athletic figure of the old-time brakeman who swung on the brake wheel to stop the train before the air brake was invented. Looking back we can see him rise from the front seat of the coach as the train approaches the station, pulling on his thick buckskin gloves as he passes through the door. The dog clicks sharply in the ratchet wheel as he swings, and we feel the grinding of the brake shoes. He peers out ahead along the train to judge the speed and distance, and finally the stop is made.

He really assists the women and children aboard instead of ordering "Step lively, there." Next we see him entering the door with a basket and child on his right arm, while with his left hand he leads another child down the aisle where he finds a seat for the mother and children. As the train starts up he walks forward and stands looking through the glass door into the coach ahead, while we gaze admiringly on the tall, wide-shouldered, athletic figure, and mentally compare his broad back to a locomotive boiler head and his long, strong arm to a freight car axle.

That was many years ago. Yesterday we saw on the —— Railroad a short, slight figure in a brakeman's uniform, standing looking through into the next car, and the whistle of the releasing air brake seemed to spitefully ask: "What has become of your man with the back like a boiler head and arm like a freight car axle?"

A Pointer for Air Brake Instructors.

In examining a man, give him an easy question occasionally, particularly if he is not doing very well. Give him a question you know he can answer. Try this once after the man has wrongly answered questions and made a mess of things generally, and you will be surprised to see him perhaps pick up and pass. A little encouragement is a great thing sometimes, and has even turned a loser into a winner.

C. P. Cass has resigned his position as locomotive engineer on the St. Louis & San Francisco to become inspector for the W. A. B. Co. at Kansas City, vice Ben Johnson, resigned.

An Important Test.

A very interesting and valuable test was recently made at the St. Paul & Duluth shops, St. Paul, Minn., by F. B. Farmer, Geo. R. Parker and Jas. Casey. Two coupled hose, with pressure connections, were subjected to a pull which was gradually increased until the hose pulled apart. The pulls required to separate the hose under different conditions are as follows:

With new packing rings and coupling rotating as pulled.......... 80 lbs.
Same test, but *not* rotating........105 "
Worn rings, coupling rotating.... 27 "

Then a pressure of 70 pounds was put in hose.

New rings (couplings would not rotate)........................267 lbs.
Worn rings (couplings would not rotate)........................230 "
Worn rings, one coupling bent down 1-32 inch................356 "
Worn rings, one coupling bent down 1-64 inch, stuck with.....588 "

In the latter test the limit of the testing machine was reached, and hammer blows were made to assist, but the coupling refused to separate.

The damage strains thus shown to which a hose is subjected when pulled apart should be a sufficient and sensible reason for uncoupling by hand. There can remain little doubt that the forcible pulling apart of hose causes many of the train-pipe leaks complained of, and has much to do with the early deterioration of rubber hose, especially at the nipple connection.

These tests also show the bad results of bending the coupling to make a tight gasket joint, as is sometimes practiced by thoughtless trainmen.

The men making these tests find, upon examination, that many coupling heads are thus bent, and recommend that inspectors and repairmen be furnished with a metal gage that the standard clearance may be maintained.

Oddly, but Well Put.

Scene—Air-brake car.

Instructor—Please tell me how you understand the quick-action triple valve operates.

Pupil—Well, you see, if you want it to work slow and easy you let the air out easy. If you want it to work quick and hard, you smash her on hard and she works straight air out of the train pipe into the brake cylinder first, and automatic out of the auxiliary reservoir last.

Instructor goes into a brown study over this crisp explanation.

Cutting Out Air Brakes to Obtain Hand Brakes.

An order recently issued by one of the middle Eastern roads is to the effect that during brake application the slack of the train shall be held stretched by hand brakes on the rear end, and air brakes shall be cut out on the rear end until sufficient hand brakes are obtained to do the holding.

As is well known, this method of train-holding is contrary to the established practice of the leading railways of the country, and will probably give way to air-brake handling again as soon as the cause of the trouble is found and corrected. Possibly the order was prompted by the rough handling of trains, in which event it would be better to correct or instruct the operators, rather than throw the brakes into disuse as the order does, and thereby invite possible disaster. This is negative progression.

An investigation of the methods employed on neighboring roads, and roads all over the country where enginemen are given full use of the air brakes, would doubtless bring results more economical, satisfactory and safe than those of trying to hold heavy trains from the hind end with hand brakes, or from both ends with air and hand brakes combined.

Fearlessness of Newspaper Reporters.

The ordinary newspaper reporter who essays to describe a railway accident, usually makes about the same mess of his job as does the green German who attempts to swear in English. Here is a sample:

"He (the engineer) didn't lose control of his machinery (air brakes). He had it under excellent control. The express messengers and all the crew assisted him nobly. With their combined efforts they locked the wheels of the entire train. Human effort could have done no more. But the train went on like a boat going down a 'shoot the chute.'"

Of course it would. If this reporter had spent a short apprenticeship around a brake wheel, he would have known that a skidding wheel does not hold nearly as well as one just before reaching the point of skidding; also that "assisting" the engineer's air brake with the hand brake is a good deal like acting frivolous with a buzz-saw.

This is the second time the Westinghouse Air-Brake Company has cut off the head of the Air-Brake Association by taking into their employ its president. C. P. Cass goes this time.

The New Dummy Coupling.

Owing to legislative action taken by the Master Car Builders' Association, permitting the omission of the coupling hook in connection with brake apparatus on freight equipment cars, and the consequent abandonment of the device by a number of railway companies of the United States, the Westinghouse Air-Brake Company has concluded to omit the "coupling hook" from its schedules of freight car brake apparatus, on orders received after January 1, 1899.

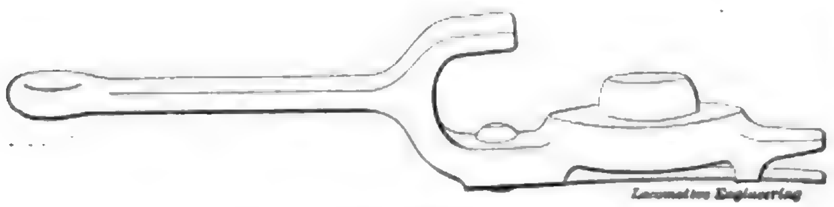


FIG. 1. THE NEW DUMMY COUPLING.

The principal reasons which led to the discontinuance of the coupling hook were: (a) Being attached rigidly to the car, the hose in many instances kinked, causing its deterioration. (b) It did not fit sufficiently close to the coupling to entirely exclude foreign matter.

The Westinghouse Air-Brake Company has made careful investigations where the use of the coupling hook has been discontinued, with the result of becoming satisfied that some device to perform its office satisfactorily is a very desirable adjunct to the brake apparatus, and they have therefore designed a dummy coupling (see Fig. 1), and which being suitably machined, enables it to be closely joined with the air-brake coupling, entirely excluding all foreign matter; and being properly attached by a short chain (see Fig. 2) to the car structure, will enable the hose to take a natural curve.

The Westinghouse people strongly recommend the use of the new device, but will furnish either form for use in connection with freight car brake apparatus at 20 cents per pair.

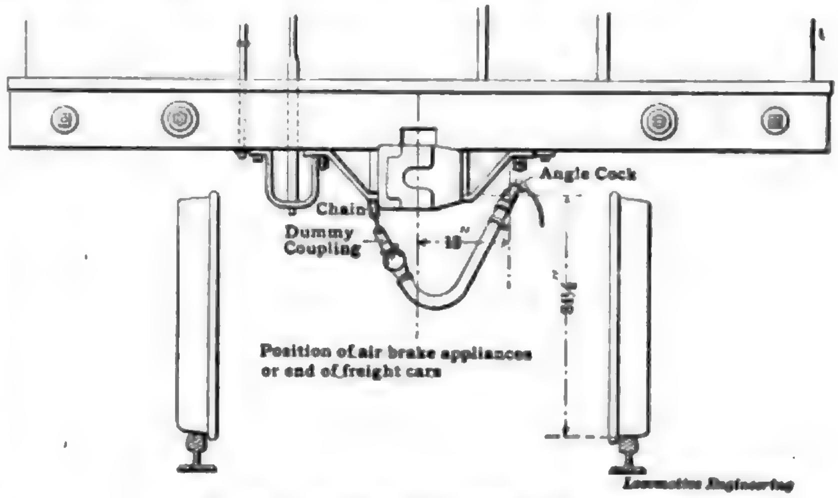


FIG. 2. THE NEW DUMMY COUPLING IN POSITION.

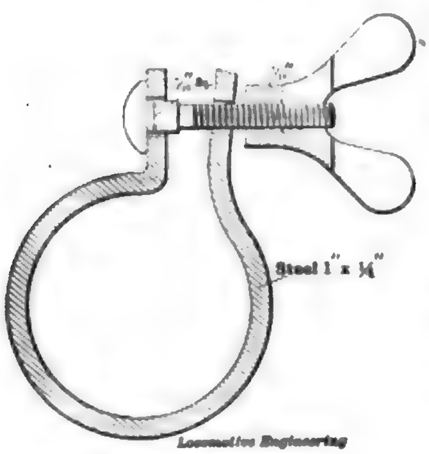
CORRESPONDENCE.

Piston Rod Clamp.

Editor:

The sketch sent herewith is of a steel grip, or strap, which the writer has found very effective for holding the release spring of the freight brake cylinder in its position between piston and cylinder head when removing the piston to clean and oil the brake cylinder.

Its form prevents crushing or injury to piston sleeve, while the thumb-screw (2½ inches width) is of ample size to tighten the strap so that it would be impossible to slip.



PISTON ROD CLAMP.

The special form of lugs to strap give the thumb-screw clearance on cylinder head.

C. R. ORD,
Gen. A. B. Insp., Can. Pac. Ry.

Toronto, Ont.

How the Conductor Gave Some Pointers.

Editor:

I was switching in the yard at C—— the other day, and trying to go ahead, stop and back up as fast as the conductor and two brakemen gave me the signals. I was getting some four or five signals behind, when the conductor got up on the engine and asked me why I did not pull her over when I got a signal so as to stop quicker. I told him that I did not want any octagon wheels on the "old girl," and that would be what I would have if I reversed the engine with the driver brakes set.

"Well," he says, "if you would just pull her over, then set the brakes, it would be all right."

This was the first pointer (worth avoiding).

Going down on the branch the other day he was riding on the engine. We were late, and I was getting over the rails pretty lively, when the train parted six cars back of the engine. I lapped the brake valve, and shut off as quick as I could, when the conductor yelled at me:

"Don't stop her! Don't stop her! Keep out of the way!"

"Oh! I won't stop her. She will do that without any help," I answered.

By that time we had got stopped and the conductor dropped off and started to walk back to the rear end of the train, and began to give me back-up signals before he got to the second car. I would like to ask how far I could have got with those six cars, five of them equipped with quick-action triples, and a set of driver brakes on the engine that always attended strictly to business, if I had not shut off.

C. W. GREEN,
Nor. Pac. Ry.

South Bend, Wash.

A Correction.

Editor:

In making the plate to show my patent on the brake valve, which appeared in the December issue, the dart which should lead to port 15 leads to preliminary port instead. Several readers of LOCOMOTIVE ENGINEERING came to me for information, saying they could not understand it, and when they are informed it is a mistake in print, it is very plain to them. Now, if it is not too late, and you can find space in the January number, will you please correct it, as there may be many readers that will not be able to understand it as it is? Would you please correct this in your next issue?

W. R. ALTER,
P. C. C. & St. L. Ry.

Dennison, O.

Special Piping Arrangement for Coupling Main Reservoirs on Double Header Engines.

Editor:

The commonest remark one hears in conversation with railroad men throughout the country is a comment on the wonderful strides made in the past decade, and a wonder as to the conditions that will exist in the early part of the coming century. Progress is in the very air we breathe, and everybody seems imbued with a desire to be in the lead. The Chesapeake & Ohio Railway is not going to be "left at the post" by any means, and with those best acquainted with it, it is a very strong "favorite" in the betting, and from present indications will be "placed," if not a winner in the race.

They are handling fifty, sixty and sometimes seventy air-braked cars there now, and their mechanical department is always trying to perfect the service in every way it can. They were among the first, if not the very first, of the Eastern roads to establish an air-brake test plant for freight service, and the wisdom and foresight of doing so is now manifest. Where other roads are cutting out air brakes, due to leakage that even a 9½-inch pump cannot supply, they are coupling up and operating all they can get. Where brakes are cut out it is done for some cause for the moment irremediable. That brake is chased up at the first inspection point and made to do its share of the work, or the management will know why.

They are double-heading on their long trains, and in order to give the lead engineer the advantage of the second pump and main reservoir, have brought into existence the method of pipework shown in the attached blueprint.

Large main reservoir capacity is of almost vital importance in handling long trains. Mr. W. S. Morris, S. M. P., was quick to see this, and is now equipping his engines with two reservoirs, as per the print. This gives each engine a main reservoir capacity of about 57,000 cubic inches, which is pretty good in itself. But when double-heading, the lead man has the advantage of the second engine's reservoir and pump, thereby giving him a main reservoir capacity of 114,000 cubic inches and two 9½-inch pumps. This without the second man cutting in or making any movement whatever to assist him, except cutting out his brake valve at the terminal.

The drawing shows how it is done. A line of 1¼-inch pipe runs from the small main reservoir back under the footboard. It is teed there (no golf slang intended) for the main reservoir connection to the brake valve, and passing back under the tender is coupled to the large main reservoir on top of the tender. On the left side of the engine a 1¼-inch pipe runs from the small main reservoir to the pilot, and from the large reservoir to the back of the tender. In double-heading, the left pilot hose on the second engine is coupled to the hose on the left side of the tender on the first engine, the stop cocks opened, the second engineer cuts out his brake valve, and there you are.

But, someone says, suppose you break in two? Well, they thought of that, too, so they devised an automatic closing valve to be put in the pipe back of the left steam chest, and again just back of the large reservoir. When the hose parts, or bursts, between the two engines, the valve closes automatically. When coupled up again it opens automatically, but will not open until the hose and pipe are in practically perfect order. The old-style hose with a check valve will not do for this, as, if a hose burst, or the pipe was broken off under the tender, the valve would be useless; so a suitable automatic valve had to be devised. This is not shown on the drawing as the detail drawing of it had not been completed when they had to make prints from the drawing shown.

They are also piping the air pump exhaust into the cylinder exhaust cavity, not a novelty by any means, but a very good idea, nevertheless. In doing this they connect the handle of the drain cock in the air pump exhaust to the cylinder cock rigging, so that this drain cock cannot be closed until the cylinder cocks are closed. Each time the cylinder cocks are opened this drain cock is opened also. This effectually does away with the throwing of greasy water on the jacket.

Mr. Morris, S. M. P., and Mr. Huntley, air-brake inspector, deserve a great deal of credit for these steps in the right direction. "CHESAPEAKE & OHIO."

Richmond, Va.

Brake Cylinder Pressure.

Editor:

In the December issue I asked a question, which you answered for me, regarding the pressure obtained in the brake cylinder when a 10-pound reduction was made. The answer was very satisfactory, but did not convey the meaning exactly as I would like it, perhaps on account of the question asked not being plain enough to get the answer required.

The information I desire is this: When we make a 5-pound reduction in train line pressure we make a like reduction in auxiliary reservoir pressure, and obtain 5-pound pressure in brake cylinder. When we make a 10-pound reduction in train pipe, a like reduction is made in the auxiliary reservoir, and we obtain about 25 pounds in brake cylinder. When we make a 15-pound reduction in train pipe, a like reduction in auxiliary reservoir is made and we obtain about 37 pounds in the brake cylinder. When we make a 20-pound reduction in train pipe, a like reduction is made in auxiliary reservoir and we obtain about 50 pounds in brake cylinder.

Now, why is it we obtain only 5 pounds in cylinder with a 5-pound reduction, while with a 10-pound reduction, or twice the first reduction, we obtain two and a half times more pressure than the reduction made? Why is it the pressure increases so rapidly with the second 5-pound reduction, and at the third and fourth reduction it falls back, thus:

5-pound reduction = 5 in cylinder.
10-pound reduction = 25 pounds in cylinder, or an increase of 20 pounds.
15-pound reduction = 37 pounds in cylinder, or an increase of 12 pounds.
20-pound reduction = 50 pounds in cylinder, or an increase of 13 pounds.

E. O. PALMER.

St. Albans, Vt.

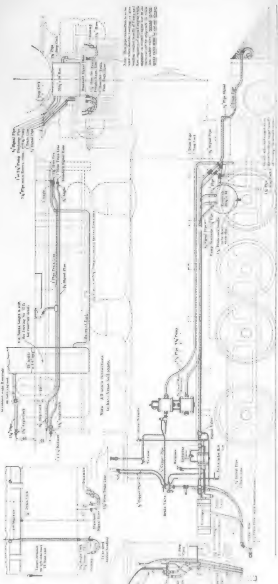
[The figures above given may vary a little on account of the condition of the triple valve brake, cylinder piston and air gage, and the figures given should not be accepted as being absolutely accurate.

The first 5 pounds going from the auxiliary reservoir to the cylinder serves only to push the piston out and make room for the air. In other words, if just before admitting the first 5 pounds to the brake cylinder, a force had been applied at the end of the piston rod to pull the piston out to the end of its stroke and bring the brake shoes up to the wheels, a vacuum would have been formed in the cylinder. Suppose we had a vacuum gage and also a pressure gage connected into the cylinder. With this condition of things the vacuum gage would show about 15 pounds and the pressure gage zero.

Now we will admit the first 5 pounds of air from the auxiliary reservoir, and we will observe the vacuum gage drop back to zero, and then the pressure gage will start up and register about 5 pounds, say. Thus we will see that pulling out the piston which makes a vacuum, and then admitting pressure, produces the same result that admitting air to push out the piston does. In both cases there is a vacuum to be destroyed before pressure can be had.

Now we will take 5 pounds more from the auxiliary and put it in the brake cylinder, and our pressure gage will run up surprisingly. This is because the auxiliary reservoir is from 3½ to 4 times the volume of the brake cylinder. If great care is taken to make a 5-pound continuous reduction each time, and the triple valve is worn to a good bearing, does not leak, is well lubricated and moves freely, the increased brake cylinder pressure will be about the same in each case. This is difficult, however, to do. The law under which compressed air works in this case is as follows: The change in pressure in the auxiliary and brake cylinder varies inversely as the volumes of the auxiliary and brake cylinder.—Ed.]

Next convention of Air-Brake Men, Detroit, Mich., April 11th, 12th and 13th. Apply early for your transportation.



CHESAPEAKE & OHIO RAILWAY SPECIAL PIPING ARRANGEMENT FOR COUPLING THE MAIN RESERVOIRS ON DOUBLE HEADER ENGINES.

Slid-Flat Wheel Reports.

Editor:

I am sending you two blank forms of report for slid flat wheels—one for the train conductor and the other for the car inspector—which I have had in use for some time and have found of considerable aid in locating properly the blame for wheel-sliding where cars have long continuous runs with different crews in charge. The conductor's report, I think, tends to make them more observing for the very fact that they know that such a blank must be filled out at the end of the run.

Some roads of which I know make it a requirement that the train conductor shall telegraph from the first station out of their terminal; but this seems to me to place upon the already over-burdened wires of most roads' telegraph system an unnecessary additional tax.

E. W. PRATT,
Gen. A. B. Insp., C. & N. W. Ry.
Chicago, Ill.

The Making of a "Tom Jennings."

Editor:

Your article entitled "Pretended Instruction Versus the Real Thing" reminds me that the fault is sometimes not with the instructor, but with the instructed.

If Tom Jennings had been working for the X. Y. & Z. road, and had gotten his air-brake knowledge from that pretended instructor, he would very likely have had as little trouble in overcoming his difficulty as he did on his own road with the "true thing."

The chances are that Tom Jennings had a little natural ingenuity of his own, and if he had never had any instruction at all, he would have found a way out of his difficulty; while if the other fellow who lost the $1,600 for his road had been working in the office or somewhere else suitable for his talents, and another Tom Jennings had been running that horse train, he would have gone through all right.

The successful engineer is born, not made.

The writer of the above article evidently thinks that an air-brake instructor can in a few weeks of an hour or so a day, make web-feet grow on chickens, or in other words take a man who should be weighing out sugar in a grocery store and make a Tom Jennings out of him.

THOMAS JONES.
Waldwick, N. J.

[As we wrote the story ourselves, we shall be obliged to take the blame. We endeavored to show the poor results of the tame system of air-brake instruction followed by some roads, and not to lay the blame for the whole numerous shortcomings of mortal railroad man to the door of that paragon of virtue, the air-brake instructor.

There are too many roads that neglect or misuse their facilities. We have in mind two or three roads which have good modern air compressors in their shops, and pipes through a large part of their yards for supplying air hoists, motors and car-cleaning devices, and have no facilities for testing air brakes. These same roads have in a dingy corner of the main shop a rheumatic 6-inch pump, wheezing off its mortal coil under the sympathetic gaze of a sectional triple, old-style governor and a sectional drain cup, from their dusty and cobwebbed pile on the floor in the opposite corner.

On one of these roads the air-brake instructor does his best, which is his worst, does not care to do any more, and is not expected to do any more unless he can do it at no expense and with no bother to his officials. It was to arouse these careless and lukewarm persons, and not to require the air-brake instructor to turn each man under instruction into a Tom Jennings, that the story was written.

While it would be expecting too much to ask an instructor to perform such an extraordinary feat of grafting mentioned, yet, by concentrated and continuous effort, a hard-working instructor has effected equally extraordinary things, so say the men back in the train.

We are reminded, by our correspondent's reference, that some of the very best railroad men we have ever seen were certain ex-grocery or lunch-stand clerks who, in the olden days, occupied the opposite box or gave us signals from the little red, dinky caboose on the rear of the train.—Ed.]

Chicago & North-Western Railway.

Daily Report of Flat Wheels under Passenger Cars at..*Station.*

....*189*

Initials	Class	Name or No.	Train No.	Eng. No.	No. Pairs Wheels Slid	Size of Spots	New or Old Spots	Steel Tired or Cast Wheels	Spots Carded? By whom	Date of Sliding	No. Pairs Wheels Removed

....Inspector.

Chicago & North-Western Railway.

CONDUCTOR'S TRAIN REPORT OF SLID FLAT WHEELS.

Train No . . . . . *Departed from* . . . . (*date*) . . . . *189*.

Car No. or Name	Engine No.	No. of Pairs Flat	Estimated Size of Spots	Where was the Pounding first noticed?	Did Damage Increase	Where did you notice Wheels Sliding?	Where was Engineer notified?
Name of Engineer..							

This Report should be filled out at Terminals and forwarded to the Ass't Superintendent.

NOTE.—Trainmen must pay particular attention to the sliding of wheels and immediately notify the engineer every time it occurs.

....
Conductor.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(9) E. W. F., Frankfort, Ind., asks:

Do you think Mr. Blackall's new book on "Air" is a good one to study for beginners? That is, does it "begin at the beginning?" A.—While it does not name and describe all the parts and passages in all the different parts as minutely as the Westinghouse instruction book, still we think it is a good book even for beginners.

(10) A. J. B., Savannah, Ga., writes:

I was interested in the story of Tom Jennings last month. You say he opened the pump throttle, and the reversing bush, piston and main valve shot up. Suppose the bush had stuck fast, like some I have seen, what would Jennings have done? A.—The story was to tell of a man who knew what to do, and not so much how it should be done. Probably a little tapping with a hammer around the outside of the tapered part of the bush would have partly loosened it, so it could be pulled out with a packing hook or some other tool.

(11) J. A. T., Syracuse, N. Y., writes:

The Air-Brake Association recommends metallic packing for air pumps. I would like to ask if it is used on many roads, and what kind do they use? A.—Metallic packing for air pump piston rods is now used quite extensively. There is a variety of different makes. The Jerome seems to give as good satisfaction as any. Some roads make their own. Care should be taken to have the rings sufficiently soft so

as not to wear the rod unduly. The temptation to make a big record may cause the rings to be made too hard, and they will wear the piston.

(12) H. D. L., Columbus, O., writes:

The 1898 Proceedings of the Air-Brake Association shows some indicator diagram cards of the air pump on pages 103 to 117. Would you please explain them? A.—These are nearly the same as a steam card, except that they are reversed; i. e., in the steam card the highest part of the card is at the beginning of the stroke, and gradually tapers down as the steam expands. In the air card the lowest part of the card is the beginning of the stroke, and the highest part is the finish. It would be impossible to analyze these cards in detail here. The subject will be taken up at length by the Air-Brake Men next April at the Detroit convention. Get their Proceedings.

(13) H. S. R., Altoona, Pa., writes:

I have an argument with a man who claims the proper place to carry a Westinghouse D-8 brake valve is in the full release position. I say running position, after train pipe is charged. He says there is no provision for an excess pressure with this valve. I say valve 21 is for this purpose, but not as reliable as excess valve attached to D-5 and D-6 valves. Who is right? A.—The D-8, or 1890 model, has an excess pressure valve, 21, for the purpose of holding an excess pressure in the main reservoir. If no excess can be accumulated when the handle is carried in running position, the valve 21 is leaking or is held off its seat by something. Possibly the rotary valve leaks main reservoir pressure into the train pipe. Should the main reservoir pressure run up and the running position act like a lap position, the valve 21 is held to its seat by gum or a too stiff spring. The D-8 valve then has an excess feature, but not the same kind of one as the E-6 or 1892 model.

(14) G. E. C., Moncton, N. B., writes:

When the engineer's brake valve is put in emergency position, and the train pipe emptied, 30 pounds train pipe pressure go to the cylinder and 40 to the atmosphere. Now if quick action can be got with a 5-pound reduction, does the same amount, 30 pounds train line pressure, go to the cylinders, and how many pounds reduction should the gage show? A.—We can't say positively that 30 pounds go to the brake cylinder and 40 to the atmosphere. At the instant of quick action application, the train pipe pressure drops to about 39 pounds. This drop is caused by the amount of train pipe pressure let out at the brake valve, plus that which goes to the brake cylinder. This is not shown on the locomotive gage, which is too far away from the triple, and therefore too slow. An ordinary gage connected into the bottom of the triple will show, however, even a greater reduction than any point in the train pipe proper. Practically the same amount of train pipe pressure goes to the brake cylinder whether the quick reduction be 5 pounds or 70, with a slight advantage in favor of the former. The reason of this is that the brake cylinder takes its allowance in a very small fraction of a second, and refuses any more, not caring whether the remainder stays in the pipe or passes out at the brake valve.

(15) E. W. F., Frankfort, Ind., writes:

1. In using the extra large reservoir which is largely in vogue on many railroads when a great number of air-braked cars are pulled, do they not carry higher pressure than 90 and 70 in main reservoir and train line, respectively? A.—1. No. 2. If not, what is their idea of going to the extra expense? A.—2. Two smaller reservoirs of the same size, or one larger reservoir twice as large as one of the smaller reservoirs will, of course, hold twice the volume of air, at the same pressure, as the smaller one, and consequently will go twice as far; or in other words, will supply twice as many cars. On the other hand, we could take one of the smaller reservoirs and by compressing air into it to 180 pounds pressure, we would have the same volume of air, and could supply the same number of cars as 90 pounds in the two smaller reservoirs or the one larger reservoir. According to the laws governing compressed air, the pressure and volume vary inversely. That means that 10 cubic feet of air at 50 pounds is the same quantity and will do the same work as 5 cubic feet at 100 pounds pressure. We have neglected the effect of heating and cooling. The objections to the small reservoir at 180 pounds are that the pump heats accordingly, brake valve works stiff, and there is a considerable loss of air in cooling when dropping from high pressure to low. Also many engines carry insufficient steam pressure to pump 180 pounds. Large main reservoir capacity is a very desirable thing. 3. And does not the governor have to be set accordingly? A.—3. No.

M. C. Hammett, Troy, N. Y., sends us samples of new grinding compounds, named "The Trojan Mineral Grinding Compound," which he recommends as first class for all kinds of air-brake work. The samples are graded, medium, fine and extra fine. They look business-like, and as Mr. Hammett is a large user of grinding stuffs, having experimented much to find the best, we feel safe in recommending the compound to users, for a trial at least.

Always Glad to Get Interesting Facts.

If you have any new schemes or devices to present, or opinions to give, that you think would be of interest to Locomotive Engineering readers, send them to us from time to time. We pay for good things. Don't hesitate because you perhaps feel you are not a skilled writer. What we want is good, interesting *facts*. We will do the touching up if there is any needed.

Chesapeake & Ohio Officials' Meeting.

The regular bi-monthly meeting of the master mechanics, general foremen, road foremen of engines and car department officers of the Chesapeake & Ohio Railway was held at Huntington, W. Va., on January 10th.

Superintendent of Motive Power W. S. Morris presides at these meetings and appoints the committees to take charge of and report on such subjects as are selected. On this occasion there were thirty-four present, which included some of the transportation department officers, two Galena Oil Company experts having charge in this district and a representative of Locomotive Engineering. All the reports submitted were discussed and criticised in a very practical manner, making it a sort of experience meeting.

Reports were made on the ton-mile base as a foundation for the computations on the monthly locomotive performance sheet, which outlined a very complete system; on rules for air-brake operating, which took up the question of double-heading, which is a vital question on this system on the mountain divisions; and in connection with this matter it was recommended that it was better to have the second engine take the slack out of the train when starting up and have the leading engine work steam next, as it was found that the train was started with less shock.

This is contrary to the time-honored practice of having the leading engine take the slack out of the train, and the following engine then begin her work.

The report of General Foreman Elvin, of the Huntington shop, on the relative expense of steel-tired wheels versus cast-iron wheels gave very conclusive figures showing that for engine, tender and coach service the steel-tired wheels cost considerably less per thousand miles run than the best cast-iron wheels. This report will appear in these columns later.

A number of large systems follow this plan of getting the men in charge of maintenance and operation of the rolling stock together at regular intervals, with good results. It is only a question of time when this practice will also be adopted by the smaller roads.

"Book of the Royal Blue" for January, 1899, has reached our table. That is a publication of the Baltimore & Ohio Railroad Company's intended to advertise the attractions of that great railroad. The January number is very handsomely illustrated and shows a variety of insides of cars, besides numerous attractive bits of scenery on the road. There are so many beautiful scenes traversed by the Baltimore & Ohio that it will take a long time for the magazine to exhaust them. The publication is got up in first-class style in engraving, printing and paper, and is in every way a credit to the publishers.

Japanese Suburban Double Ender.

The double-ended suburban locomotive shown is one of twenty-six recently built for the Nippon Railway of Japan by the Schenectady Locomotive Works. The gage is 42 inches, and the engine weighs 86,700 pounds in working order, 51,700 pounds of which rests on the driving wheels. An unusually short rigid wheel base of 5 feet 6 inches provides a very flexible machine. The total wheel-base is 21 feet. The cylinders are 14 x 22 inches, and the driving wheels 56 inches diameter. The principal dimensions of the engine will be found on the skeleton diagram on page 97.

Among the equipment and attachments are Jerome metallic gland packing, American balanced valves, Nathan non-lifting injectors, Coale safety valves, Smith's automatic vacuum brake, magnesia sectional lagging for boiler and cylinders, and Crosby chime whistles.

SUBURBAN DOUBLE-ENDER FOR JAPAN.

Not Sure that Electricity is Cheaper than Steam.

The small locomotives employed hauling the trains on the elevated railroad of New York do their work as regularly, as cleanly and as quietly as any kind of motive power, and yet there are constantly rumors afloat that electricity is about to be substituted. It is very difficult getting the officials of the company to talk about the real status of the motive-power question, but Russell Sage, one of the directors of the Manhattan Railway Company, recently talked freely to a reporter of the *New York Sun*. The most important part of the interview reads:

"We had a meeting of the board, at which Mr. Westinghouse made an estimate of the cost of equipping the road with electricity. We all agreed that the estimated cost was too high, and Mr. Gould asked if he could get an expert of his from the Union Pacific to study the question. We said he could—it was unanimous. The expert is still at work, and we have a committee of the board looking into the matter. We have had several meetings of the board to talk the thing over and we're still at work on it.

"You see, we don't want to expend eight to fifteen million dollars on this thing unless we know just what we're going to get. Now, Westinghouse is an expert and a friend of mine, and he ought to know something about it, but he isn't very sure about the thing. Four years ago he came to me and said we could save $600,000 a year by using electricity—and $600,000 a year is tempting. I asked him to look into it. He kept me waiting a couple of years and then he wasn't so sure about it.

"'Hold on to your steam for a while,' he said.

"So you see, there's nothing sure about this. I don't know anything about electricity, and they all seem a little in the dark about it. You see a man climb a pole, and the next thing he comes down flop—dead. We run trains under two minutes' headway in the rush hours on Third avenue and under two minutes' headway on Sixth avenue, and we carry 500,000 people a day. We can't have any delays or accidents. I am proud of the fact that we have never killed a passenger, and with some new arrangement, if two trains should run into each other, fifty people might be killed, and that might bankrupt the road."

There has been a great deal of loose talk about the advantages of operating railroads by electricity, but the increase of experience with electricity where steam has previously been used decreases the tendency of steam-operated roads to change. It is now admitted that the saving of fuel effected by changing from locomotives to electric motors is trifling, and the principal claim now made is that the acceleration of trains into speed could be made more rapid by the use of an electric motor than the locomotive is capable of. That is merely a case of adding power, and locomotives could easily be increased in power, if the structure is heavy enough to carry them. After a very careful study of the situation, we doubt very much if electric motors will ever be used to operate the trains on the New York Elevated railroads.

The Newton Machine Tool Works of Philadelphia report that their recent shipment of a large armor plate saw to the Bethlehem Iron Company, South Bethlehem, Pa., was so satisfactory that they have since received additional orders from this company. They also have an order from the Carnegie Steel Company for an armor plate cold-cutting saw which is highly satisfactory. The Carnegie Company have tried several makes of cold saws, both foreign and domestic, but have placed their order direct with the Newton Machine Tool Works for this large cold saw. They also advise the receipt of large foreign contracts, and are rushed with other orders as well.

Black Diamond Express Cars.

The very handsome cars illustrated in the following photographs constitute the Black Diamond Express of the Lehigh Valley Railroad. They are all very beautifully finished inside, and form one of the handsomest trains to be found in this or any other country. All the cars were built by the Pullman Company, and are very creditable productions of the highest car-building art.

Where Economy of Oil is Not Considered.

"Economy of oil" in train service has not yet become a source of torture and annoyance to the enginemen of Mexico. In fact, instead of curtailing the supply, the tendency is to demand that locomotive bearings shall receive a certain very liberal supply per hundred miles run. This has cultivated habits of carelessness among the enginemen, and they waste oil in a fashion that would seem outrageous to people in the United States. While allowing a very liberal oil supply, the officials are very strict about applying discipline when any part of the motion gets damaged for want of lubrication. The usual plan is to fine the man responsible a sum equal to the value of the damage done.

An engineer was oiling round one day in Mexico, and he was using an oil can with a broken spout which did not nearly reach the cups on the eccentric straps. To put the necessary supply into the cups, he kept jerking the oil can to and fro, making it squirt its contents over the cup, pouring on the ground about one hundred drops for one that went into the oil cup. As he was engaged on this operation the superintendent of motive power appeared, and after looking for a minute at what was going on, remarked:

"My man, don't you know that the oil you are pouring on the ground costs money?"

"I don't know anything about that," remarked the oil-pourer, "but I know that if I break that eccentric strap it will cost me $16," and he continued to pitch the oil towards the oil hole.

C. & O. Drafting School Room.

During a recent visit of a representative of LOCOMOTIVE ENGINEERING to the Chesapeake & Ohio shops at Huntington, a call was made at the drafting schoolroom.

There we found about forty of the apprentices hard at work under the charge of Instructor E. C. Fisher. This school was started in July 1896, in a room fitted up over one of the shops, and is the especial pride of Master Mechanic Stewart and Instructor Fisher, who say that about 10 per cent. of the pupils will make expert draftsmen, and the others who do not follow up the business as a profession are better mechanics all their life for the drill in the elementary principles in machine work and construction which they learn here; the education which the eye and hand get here is valuable.

The school is open after the regular hours of work in the shop are over; none of the time needed for work in the shop is taken up by the lessons or work in the school, so no machines that are operated by the apprentices are idle.

The progress made by some of the pupils is marvellous. In addition to educating the apprentices, so that they will be more valuable workmen when they finish their course in the machine shop, they are encouraged by the idea that so much is done for them. Of course, some are more proficient than others, some try harder; natural aptitude helps out most.

In starting apprentices preference is given to the sons of old and trusted employés, who have had the benefit of a good education. As there are always more applicants than positions open, the best material can be selected. A point of some value in this educational course is that when a workman is thus perfected, he naturally works into a place as a journeyman in the service of the Chesapeake & Ohio.

Drafting is the language of mechanics, and it pays to learn it right in the first place, so that you can read it plain, as well as be able to write and speak it so others will understand your meaning.

In an interesting article published in the "Bulletin of the International Railway Congress," M. Maurice Dumoulin, a famous French engineer and author, endeavors to forecast the principal features of the locomotives which will be needed to draw the heavier trains of the future at the constantly increasing speeds demanded by the public. Owing to the limitations imposed by the gage, and clearances necessary, the writer thinks that the number of different types must decrease as the power of the engine increases. To obtain more powerful locomotives it will be necessary to increase the size of the boiler, and in particular that of the firegrate. The size of the cylinders can easily be greatly augmented, though it will be necessary to place them outside the frames, but it is much more difficult to obtain larger grates and fireboxes for the boiler.

We are informed by Mr. J. R. Gould, general foreman of the Chesapeake & Ohio shops at Richmond, Va., that the pump described on page 61 of our January number is not used to wash out boilers, but for the purpose of testing boilers after they have been repaired.

INTERIOR PARLOR CAR, LEHIGH VALLEY BLACK DIAMOND EXPRESS.

INTERIOR DINING CAR.

Safety Appliances.

The following extracts are taken from advance sheets of the coming annual report of the Interstate Commerce Commission:

"As stated in the last annual report, the Commission granted numerous competitive carriers an extension of two years from January 1, 1898, within which to comply with the requirements of sections 1 and 2 of the Safety Appliance Act, and required the companies whose equipment was incomplete to make semi-annual reports showing the progress thereafter made. On May 19th the carriers were notified to file such a report for the six months ending June 1, 1898. Returns received from 283 of the 294 carriers which were granted an extension of time show 1,156,616 freight cars owned, an increase of 20,611 over the number reported on December 1, 1897. During the six months 119,938 freight cars were equipped with automatic couplers and 67,400 were fitted with train brakes, making a total of 795,253, or 69 per cent., having automatic couplers, and 511,666, or 44 per cent., equipped with train brakes, up to June 1, 1898. On that date 29,175, or 90 per cent., of the total number of locomotives owned by these reporting carriers were equipped with driving-wheel brakes.

The returns for the six months ending December 1, 1898, are not yet filed, but it is believed that they will show reasonable progress and indicate the probability of full provision of automatic couplers and the required number of train brakes on January 1, 1900, the date when the extension order will expire. Thousands of cars have been inspected during the year, but comparatively few were found not to be in conformity with the law in respect to drawbars and handholds. With regard to a suggestion that the Commission should increase the maximum hight of drawbars from 34½ to 35 inches, the Commission says that the standard hight of 34½ inches was designated by the American Railway Association under authority expressly conferred by the Safety Appliance Act, and having been so fixed, in conformity with the act, it can only be changed by the action of Congress.

"Since the enactment of the law in 1893 there has been a decreasing number of casualties. There were 1,034 fewer employés killed and 4,062 fewer injured during the year ending June 30, 1897, than during the year ending June 30, 1893. In the Spanish-American war 298 men were killed and 1,645 were wounded. In 1897 there were 1,693 men killed and 27,667 injured from all causes in railway service. In coupling and uncoupling cars alone 219 less men were killed and 4,994 less were injured in 1897 than in 1893. The number of such employés killed has been reduced one-half, and the number of injured also practically reduced one-half. The reduction in the number of accidents from all causes largely exceeded in a single year the entire casualties during the late war."

LADIES' ROOM, PARLOR CAR.

INTERIOR PARLOR CAR.

Don't Neglect Trifling Details.

Very small straws indicate how the current flows. Very small characteristics indicate how the habits of a young man turn. Talking on this subject a well-known road foreman of engines remarked: "When I got a new fireman I always judged his usefulness and ability by what may seem trifling tests. I would tell him to fill the oil cans and watch to see how the work was done. If he filled the can carefully and permitted no useless waste, then I would say there is something in that man. If he kept pouring oil out of the big can until he permitted a big stream to spread over the end of the tank, then I would say to myself, that man is a natural slouch. That method of judging never failed to prove correct."

These and other small things deserve attention. If a young man is ambitious to achieve success as a fireman or as a superintendent of motive power, for instance, we advise him to start out by giving the details all the attention which they deserve.

Discussing Signaling.

At the meeting of the New York Railway Club on January 19th, Mr. Chas. Hansel gave a very interesting talk in connection with his paper on "Railway Signaling," which was the subject for discussion. This talk was illustrated by stereopticon views of the cuts shown in the printed report. A small working model was shown and passed around among the members, of a two-blade signal which could be set for block with both blades, clear with both blades, or at a permissive block which Mr. Hansel names "Caution," by clearing the full end blade and holding the fish-tailed blade at block.

This signal was criticised by several members, who spoke of the construction of the actuating devices on the semaphore post allowing the signal blade to go to or remain at clear when the lever in the cabin had been placed at block.

Another point in the report which was criticised was the proposal to change the term "Supplementary block" used in the code of rules adopted by the American Railroad Association to the term "Yard limits." This as was shown would cause

confusion, as the term "Yard limits" is universally used for another and quite different purpose. It is not good practice to change the use of standard terms and apply them to new conditions which are totally different.

This report was commended by some and criticised by other speakers. As the hour was late, the president gave notice that Mr. Hansel could reply in the printed Proceedings of the meeting.

The Seymour Rotary Engine.

Chicago and vicinity seem to be getting stirred up over a rotary engine which is going to revolutionize steam engines generally, from the small yacht engine to the locomotive. It is called either a turbine or a rotary, depending on who is talking about it, but the drawings we have seen show it to be a rotary, and rather an expensive construction at that.

It is very similar in idea to one of the leading air motors, and will probably answer very well in cases where a compact motor is needed and economy is not a serious question. In spite of all claims to economical steam consumption, based on cutting off steam with a rotary valve, it does not seem probable this can approach even an ordinary high-speed engine, to say nothing of the Corliss or similar type; and if an engine of this kind can be kept even ordinarily free from leakage of steam past the pistons (or wings), it would seem as though we were over anxious in this respect with the ordinary engine. It is also talked of applying this to the locomotive, and wonderful results are promised—as usual. There is the usual talk of doing away with reciprocating parts, side rods, etc., etc., all of which would be desirable if it was not necessary to introduce more objectionable features in their place. In this case we fear the medicine is more fatal than the disease, and while prophecy is dangerous, we shall look for the electric locomotive on trunk lines before the advent of the Seymour rotary engine.

There are, of course, the usual large orders, the opinion of experts as to its great value, offers of millions for State rights, etc., etc.; but we fear we have grown hardened by experience, and must be considered doubting Thomases in this case.

LIBRARY AND SMOKING COMPARTMENT.

INTERIOR DAY COACH.

We are indebted to Mr. Tait, manager of the Eastern lines of the Canadian Pacific, for a copy of quite an elaborate method of tonnage rating used on the Ontario and Quebec divisions. The haulage capacity of nearly all the locomotives is given, and also estimated empty weight of all classes of cars. Then tables are arranged showing the tonnage to be hauled by every size of locomotive under different conditions of weather. For fast freights a deduction of 10 per cent. is made from the load of ordinary freight trains, and other deductions are made for all trains for bad rail, temperature 32 degrees above zero, temperature zero to 20 degrees below zero, and for temperature colder than 20 degrees below zero. Superintendents may in special cases authorize a special rating. Five tons is added to the stenciled weight of an empty car. The arrangement seems calculated to promote harmony between trainmen and yard masters.

The reports sent out monthly by Mr. J. B. Thomas, general manager of the Nashville, Chattanooga & St. Louis, about the causes for trains parting have stirred up many other railroad companies to keep notes of what causes this form of annoyance, expense and delay. So far as we have learned, the consensus of opinion blames the spindle drawbar for most of the trouble. When the application of the yoke becomes general the annoyance from parted trains will be greatly reduced. Meanwhile it would be interesting to know what railroad companies are ordering new cars and specifying that the couplers shall be secured by the disreputable spindle.

"Kilburn's Standard Hand-Book for Railroad Men." By A. Kilburn. Illustrated. \$1. Published by Laird & Lee, Chicago, U. S. A.

This book has 131 pages of reading matter, 3¾ x 6 inches, a convenient size for the pocket. It contains condensed information on the care and operation of locomotives, valve setting and break-downs. While this information is brief on account of the small size of the book, and in some points is open to criticism as to its correctness, yet it is valuable to anyone in charge of a locomotive. Pages 43 to 109, inclusive, relate to the automatic brake and its operation.

Intimation has been given that on the first of the year the Nashville, Chattanooga & St. Louis will share the prosperity it is enjoying by raising the pay of some of its employés 5 per cent. This will raise the pay to the point it was at three years ago when a reduction was made.

Friction of Slide Valves.

A great many experiments have been made, especially in this country, to try and find out the amount of power required to move slide valves under different conditions, but the apparatus employed was never entirely satisfactory until lately, and consequently the figures obtained were not considered entirely reliable. Three years ago a committee appointed by the Railway Master Mechanics' whose readings were influenced by the way it was handled.

A variety of other engineers had made tests on the friction of slide valves, among them Mr. J. A. F. Aspinall, of the Lancashire & Yorkshire Railway, who in 1889 read a paper before the Institute of Civil Engineers, giving particulars of experiments made on the friction of locomotive slide valves. At that time he was not entirely satisfied with the dynamo- friction diagrams were taken from the dynamometer, were of the ordinary length, the motion being obtained by suitable mechanism from the piston crosshead; but in the present experiments the motion was obtained from the valve spindle crosshead, this being considered a more accurate method of ascertaining the steam pressure at any known position of the valve. It then became easy to obtain a simultaneous record giving a friction

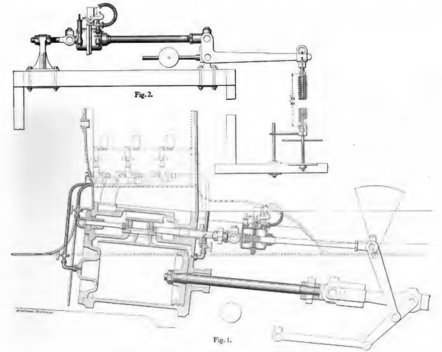


Fig. 2.

Fig. 1.

APPARATUS USED IN MEASURING THE FRICTION OF SLIDE VALVES.

Association, of which Mr. G. R. Henderson was chairman, made an exhaustive series of tests on the experimental locomotive at Purdue University, and they were aided in the work by Professor Goss. The results of a great many tests went to show that valves balanced 60 per cent. of their area were moved with less than half the power required to move an unbalanced valve. There was, however, considerable doubt about the accuracy of the tests, for the dynamometer employed to measure the extent of resistance to valve movement was a rather crude affair, meter employed, but he kept working at the problem and in time perfected an apparatus which seems entirely reliable. With that new apparatus he made some tests on slide valves that are described in a paper recently presented to a meeting of the Institute of Civil Engineers. A general view of the apparatus employed is shown in the annexed engraving, lent us by the *American Machinist*.

The paper tells that in the 1889 experiments the indicator diagrams which were taken to show the work done in the engine cylinder at the same moment that the diagram, a steam-chest diagram and a steam-cylinder diagram, thus eliminating any error that might have been present had these diagrams been taken one after another.

The valve-spindle was so packed as to be easily moved up and down in its position by hand. The speeds at which the diagrams were taken varied between 6 miles and 18 miles per hour. Two kinds of valves were experimented with; one, an ordinary D valve made of phosphor-bronze; and the other of Richardson type, with an open back, made of cast

iron, the strips and the fixed plate against which the valve slides being also of cast iron.

Thirty-one sets of diagrams were taken with the D phosphor-bronze valve, the average coefficient of friction being 0.0878, and six diagrams were taken with the cast-iron Richardson valve, the average coefficient of friction being 0.0919.

The good results obtained with the Richardson valves have caused the author to modify the views he previously expressed as to the advantages to be obtained from balancing. As a sight-feed lubricator was used in the experiments, it was easy to watch the result of increasing the number of drops of lubricant per minute, and it was found that there was a perceptible improvement in the ease of movement of the valve when the lubricant was increased.

The steam pressure during the 37 tests averaged 154 pounds per square inch. The average power required to move the unbalanced valve was 1946.18 pounds; the average power required to move the balanced valve was 854.3 pounds.

The experiments show that the friction of slide-valves is somewhat greater against a horizontal than against a vertical face; the coefficient of friction found in the 1889 experiments for valves on a vertical face was 0.068, while in the experiments dealt with in the present paper, the average coefficient was found to be, for the unbalanced valve 0.0878. There is a considerable advantage in having to overcome a force of only 854.3 pounds for the balanced, as against a force of 1946.18 pounds for the unbalanced valves.

In connection with the 1889 experiments, opinions have been expressed that the use of the whole of the area of the back of the D-valve, when estimating the coefficient of friction, was erroneous; on the ground that the only area affected by the pressure in the steam-chest was an area equivalent to that of the steam-ports. The argument is that if a flat plate of the same superficial area as the back of the valve were moved over another plate of the steam-chest, there would be no friction; but if the lower plate had a hole, say 2 inches in diameter, bored into it, the force required to move the flat plate would only be that due to the pressure of steam multiplied by the area of the hole, and as this opening became greater, so the force required to move the valve would also become greater. In order to test this question, an experiment was made on another engine of the same class. A cast-iron plate was laid upon the ordinary valve face, and through it a 2-inch hole was bored. An ordinary phosphor-bronze unbalanced D-valve worked upon it, and the same dynamometer and recording arrangements were used for these experiments as for those recorded in the first part of the paper. With this arrangement, it was found that a force of 2,195.9 pounds was required to move the valve with a pressure of 160 pounds per square inch in the steam-chest. The plate was then taken out and the 2-inch hole was enlarged to 4 inches, and five 1-inch holes were drilled over each of the steam-ports. The dynamometer recorded exactly the same force of 2,195.9 pounds under these conditions. The intermediate plate was then removed and the valve was dropped upon the ordinary cylinder face, with the result that exactly the same force was found to be necessary to give movement to the valve. The author is of opinion that this experiment disposes of the view that the area of the steam-ports only should be taken into account.

In the discussion that followed the reading of the paper, Mr. Aspinall said that with all balanced valves an important point occurred in locomotive work which did not apply in stationary or marine engines. With an ordinary valve when an engine was running down hill or approaching a station with the steam shut off, the little pressure at the end of the cylinder when the piston reached the end of the stroke lifted the valve off its seat With an ordinary valve the rise of pressure at the end of the stroke was very slight; with the Richardson valve it was 3½ pounds per square inch. The same thing happened with piston valves. A perceptible retardation was found, and to that extent it was a disadvantage to balance the valves.

Mr. F. W. Webb, London & North-Western, expressed pleasure at learning that Mr. Aspinall had come to recognize the advantages of the balanced valve. He had considerable experience with the Richardson valve, and as an experiment he took the strips out of ten engines and immediately an outcry came from the drivers, and the consumption of coal ran up 1½ pounds per mile. He uses vacuum valves on the steam-chests, which prevents the smoking-in of hot air and dirt from the smokebox. It also received the retarding effect due to partial vacuum in the cylinder when engine was running with steam shut off.

Several other speakers expressed themselves in favor of balanced and piston valves.

The Populist Legislatures of the United States do not have a monopoly in trying to harass railroad corporations and put all possible burdens upon them. On a route between Berlin, Germany, and Zurich, Switzerland, 607 miles long, a buffet car runs through, and it was intended that its occupants should be able to get refreshments anywhere on the route. But the managers had not reckoned with the canton of Aargan, between Basel and Zurich, across which for thirty-nine miles the train runs. The canton had no objection to the car, but levied a tax of 1,000 francs per year on the lessee. Wherefore the latter has his car kitchen sealed up during the passage through Aargon, and the canton gets no tax, and the passengers satisfy their hunger and thirst before or after such passage.

President Stackhouse, of the Cambria Steel Company, has issued the following announcement: "The Cambria Steel Company, having leased the Cambria Iron Company's works, has consolidated its New York offices (heretofore at 100 Broadway and 33 Wall street) at the new Empire Building, 71 Broadway, rooms 1705 and 1706. We have appointed Mr. H. L. Waterman our general sales agent for New York City and vicinity, but he will give special attention to the sale of structural steel, steel bloomers, billets and slabs. Mr. W. A. Washburne will give attention to negotiations for steel rails and railway track fastenings. Mr. L. R. Pomeroy will give attention to steel axles and our other forging specialties. Mr. Thomas F. Russell, 102 Chambers street, New York, will sell, as heretofore, the special products of our Gautier department."

C. E. Hall, a switchman on the Chicago, Rock Island & Pacific, recently obtained a verdict in a Des Moines, Iowa, court for $23,000 for the loss of an arm, but a motion for a new trial was made on the grounds that brakemen had been allowed to give evidence as expert testimony. Judge Conrad, before whom the case was tried, granted a new trial, admitting it was a mistake for the brakemen to be considered experts. We certainly cannot agree with the opinion of Judge Conrad. If a brakeman is not an expert on coupling cars, we would like to know where one can be found.

"The Manning Improved Rail" is the name of an illustrated pamphlet which we have received. It describes an improvement in the form of rail heads, designed by Mr. William Thurston Manning, C. E., for the purpose of prolonging the life of the rail. It is the very sensible and common-sense plan of enlarging the section of the rail at the point where it wears most, and this is done without enhancing the cost. Persons interested in reducing the cost of permanent way should send for this pamphlet. It may be obtained from Mr. J. H. Maddy, Baltimore & Ohio Railroad, Baltimore.

The Railway Times of India is a new weekly journal published in Bombay, the annual subscription price being six rupees, or a little more than two dollars. It is published in the interest of the European railway employés of India, and they seem to be in need of an organ that will stand up and insist that white men in India are entitled to humane treatment. Bureaucracy is the most heartless tyrant the world knows to-day. That is the kind of rule that manages the railways in India, and it goes without saying that the mass of the employés are treated unfairly. The paper is well edited and is fairly well printed.

PERSONAL.

Mr. Frank Hunt has been appointed general foreman of the Port Arthur route at Stanberry, Mo.

Mr. Henry S. Carroll has been appointed general manager of the Litchfield, Carrollton & Western.

Mr. Frank Sherman has been appointed instructor on the Louisville & Nashville air-brake instruction car at Louisville, Ky.

Mr. John S. Lane, auditor of the Darien & Western, has been appointed general manager, with headquarters at Darien, Ga.

Mr. Edward Worman has been appointed master mechanic of the Louisville, Evansville & St. Louis shops at Princeton, Ind.

Mr. F. F. Whitney has been appointed general foreman of the Wabash shops at St. Thomas, Ont., vice Mr. J. E. Mulfield, resigned.

Mr. T. E. Harwell, general foreman of the Mobile & Birmingham, at Mobile, Ala., has been appointed master mechanic at that place.

Mr. G. E. Mulfell has been appointed master mechanic of the Grand Trunk at Fort Gratiot, Mich., vice Mr. R. Patterson, transferred.

Mr. A. Branin has been apointed assistant superintendent of the Bellingham Bay & British Columbia, with headquarters at New Whatcom, Wash.

Mr. Karl Zink, assistant engineer of the Pittsburgh & Lake Erie, has been honored by being elected second lieutenant of the Seventeenth Regiment, N. G. P.

Mr. Edward D. Seitz has been appointed purchasing agent and secretary of the Louisville, Evansville & St. Louis, with headquarters at Louisville, Ky.

Mr. R. Patterson, master mechanic of the Grand Trunk at Fort Gratiot, Mich., has been transferred to Stratford, Ont., to succeed Mr. J. D. Barnett, resigned.

Mr. J. H. Hamilton, superintendent of the Ohio River Railroad, has been promoted to the position of general superintendent with office at Parkersburg, W. Va.

Mr. J. E. Irwin has been promoted to the position of general foreman of the Toledo & Ohio Central Railway shops at Kenton, Ohio, vice Mr. J. M. Dow, resigned.

Mr. Douglas Stewart has been appointed master mechanic of the Rio Grande Sierra Madre & Pacific, with headquarters at El Paso, Tex., vice Mr. H. P. Olcott.

Mr. V. A. Riton has been appointed superintendent of the Scioto Valley Division of the Norfolk & Western, with headquarters at Kenova, W. Va., to succeed Mr. Joseph Robinson, resigned.

Mr. John McManis, traveling conductor on the Oregon Short Line, has been made superintendent of the Montana division, with headquarters at Pocatello, Idaho, vice Mr. C. A. Boies, resigned.

Mr. F. E. Dewey, heretofore superintendent of the New York, New Haven & Hartford, has been appointed general manager of the Detroit & Lima Northern, with headquarters at Detroit, Mich.

Mr. S. T. Fulton, chief clerk to the president of the Kansas City, Fort Scott & Memphis, has been appointed assistant to the president of the roads comprising that system, with office at Kansas City, Mo.

Mr. C. N. Woodward, assistant superintendent, has been appointed superintendent of the Midland division of the New York, New Haven & Hartford, vice Mr. F. E. Dewey; headquarters, Boston, Mass.

Mr. J. D. Clark, superintendent of the Mobile & Birmingham, has been appointed general superintendent, with headquarters at Mobile, Ala., and the position of superintendent has been abolished.

Mr. E. C. Manson, chief train dispatcher of the Idaho division of the Oregon Short Line, has been appointed superintendent of that division, vice Mr. H. E. Van Housen, resigned; headquarters at Pocatello, Idaho.

Mr. L. W. Allibone, assistant engineer of the New York division of the Pennsylvania Railroad, has been appointed superintendent of the Bedford division at Bedford, Pa., succeeding Mr. F. P. Abercrombie, transferred.

It is reported that Mr. Ben Johnson, for several years agent for the Westinghouse Air-Brake Company in the district around Kansas City, has been appointed master mechanic of the Atchison, Topeka & Santa Fé, with headquarters at Tokepa, Kan.

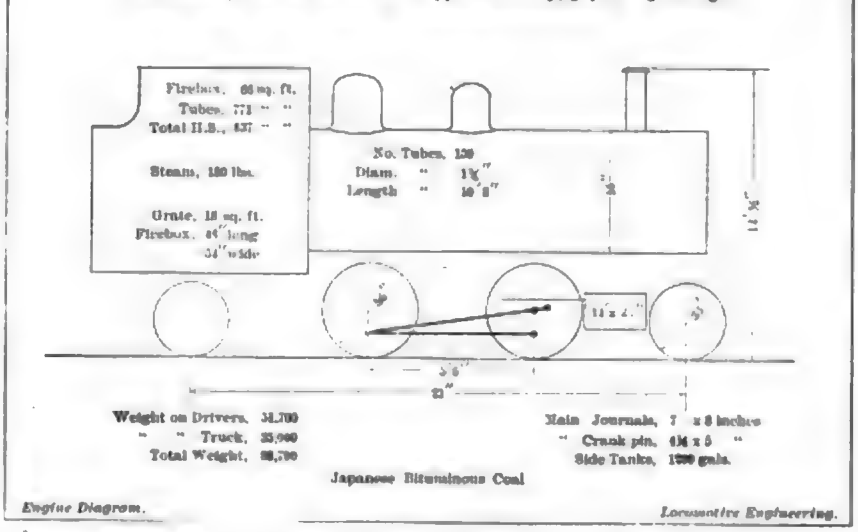
Mr. J. H. Goodyear, chief clerk to the master mechanic of the Chicago Great Western, whose writings our readers are familiar with, has been appointed assistant general superintendent of the Buffalo & Susquehanna, with headquarters at Buffalo, N. Y.

Mr. S. P. Hutchinson, assistant engineer of the Philadelphia division of the Pennsylvania Railroad has been promoted to the position of superintendent of the Lewistown division at Lewistown, Pa., in place of Mr. Victor Weirman, transferred.

Mr. Charles Sheldon, general manager and treasurer of the Consolidated Car Heating Company, Albany, N. Y., has resigned to accept the position of general manager of the Chihuahua & Pacific, with headquarters at Chihuahua, Mex., vice Mr. E. S. Safford.

Mr. F. O. Melcher has been appointed acting general superintendent of the Fitchburg Railroad, vice Mr. C. L. Mayne, resigned. Mr. Melcher recently resigned the position of chief engineer of that road and was appointed superintendent of the Fitchburg division.

Schenectady Double Ender for Nippon Railway, Japan. 3' 6" Gauge.



The Chicago, St. Paul, Minneapolis & Ohio Railroad has appointed the following instructors on the use and economy of fuel: J. J. O'Neil, Eastern division; W. L. Works, Northern division; W. L. Kellogg, St. Paul & Sioux City division, and J. F. Wallace, Nebraska division.

Mr. T. J. English, superintendent of the Cincinnati & Sandusky division of the Cleveland, Cincinnati, Chicago & St. Louis, at Springfield, Ohio, has been appointed superintendent of the Chicago division of the Baltimore & Ohio, vice Mr. P. C. Sneed, resigned; headquarters at Garrett, Ind.

Mr. P. D. Plank has been appointed master mechanic of the Louisville, Henderson & St. Louis Railway at Cloverport, Ky., succeeding Mr. David Van Alstine, resigned to accept the position of master mechanic of the Chicago & Great Western at St. Paul, Minn. Mr. Plank was

formerly an engineer on the road, and we believe that a very judicious selection has been made for that position.

Our associate editor, Mr. Clinton B. Conger, will be permanently located in Chicago, where he will devote himself to keeping in touch with Western railroad men and matters. His address will be in the Rookery Building, where he will be glad to see friends of LOCOMOTIVE ENGINEERING.

Mr. D. C. Courtney, division master mechanic of the Middle division of the Baltimore & Ohio, at Cumberland, Md., has resigned to take a position with another road. A large number of the employés presented him with a handsome diamond ring and silk umbrella as a mark of their appreciation.

Mr. James McDonough has been appointed road foreman of engines of the Gulf, Colorado & Santa Fé, with headquarters at Galveston, Texas. He was traveling engineer and assistant master mechanic of that road from 1890 to 1896, when the office was abolished, and since then he has been engineer.

Mr. C. P. Cass, of the St. Louis & San Francisco Railway, has been appointed inspector for the Westinghouse Air-Brake Company, with headquarters at Kansas City. We congratulate both the Westinghouse Company and Mr. Cass on this appointment, which will be for their mutual advantage. Mr. Cass is president of the Association of Railway Air-Brake Men, in which he has a host of friends.

Mr. John K. Lencke, the well-known Q & C engineer, is traveling in Europe, and expects to visit Great Britain, France, Germany, Norway, Sweden and Russia. His mission is to introduce to railroad officials in the countries visited the various devices made by his company. As Mr. Lencke is a good linguist and a man of alluring address, we expect he will return loaded with orders.

The business associates of Mr. C. F. Quincy have presented him with a loving cup, a very handsome "silver tassie" with a man shown in the act of trying to hit a golf ball. We have a misty recollection of Mr. Quincy telling us about his experience as a golf player, and if we mistake not, he said that his friends accused him of trying to dig potatoes when he was merely making vigorous efforts to hit the ball, the club insisting of its own volition in digging up a foot or two of earth. We presume, however, he must be an expert by this time.

Among recent changes among Pennsylvania officials is one which brings our genial friend, Mr. Frank L. Sheppard, from Altoona to be general superintendent at Jersey City. Mr. Sheppard was born within smell of salt water, and like many others who enjoyed aquatic amusements in their youth, he never was satisfied with the landlocked life of Altoona. There he passed from machinist apprentice to general superintendent, and was a decided success on every rung of the up-going ladder; but he feels more at home in an office with windows looking upon the Hudson River.

Mr. John F. McIntosh, locomotive superintendent of the Caledonian Railway, who is known to our readers on account of various locomotives of his design having been illustrated in our columns, has received a great many high compliments as a locomotive designer. The Belgian Government invited him to design locomotives suitable for different lines and different kinds of services, and his designs were made standard. Now a railway company in London has secured one of the engines built by Mr. McIntosh to make experiments in running fast express trains between London and Dover.

Mr. F. D. Underwood has resigned as general manager of the Minneapolis, St. Paul & Sault Ste. Marie, to accept the position of general manager of the Baltimore & Ohio. He has been in railway service since 1868, when he went with the Chicago, Milwaukee & St. Paul as a clerk. He remained with that road for eighteen years, where he worked his way up from brakeman to division superintendent, resigning that position to become general superintendent of the Minneapolis & Pacific, which road was consolidated with the Minneapolis, Sault Ste. Marie & Atlantic in June, 1888, under the name of the Minneapolis, St. Paul & Sault Ste. Marie.

Mr. J. W. Duntley, president of the Chicago Pneumatic Tool Company writes us from Europe that his London house has sold several large plants of pneumatic tools to go to India, and also an outfit of the Boyer tools for work in the diamond fields in Africa. He states also that last month they received a large order from Egypt for equipment for a railroad shop there. The English railroads report to him that while labor there is very much lower than in America, yet they are able to show a great saving in their work by the use of the Boyer pneumatic tools. While this saving has long been realized by the American railroads, it is especially complimentary to the Boyer tools to meet with such favor among the English roads.

The following appointments have been made on the Colorado & Southern Railway: Mr. J. J. Cavenaugh has been appointed division master mechanic, in charge of Denver shops, and Pueblo, Clear Creek, Fort Collins and Wyoming districts, with headquarters at Denver, Col.; Mr. D. Leonard has been appointed division master mechanic, in charge of Como shops, and Platte Canon, Leadville and Gunnison districts, with headquarters at Como, Col.; Mr. T. M. Gibb has been appointed division master mechanic, in charge of Trinidad and Gulf Junction shops, and Trinidad and New Mexico districts, with headquarters at Trinidad, Col. All motive power employés will report to and receive their instructions from the division master mechanic.

Mr. Edmund Pennington, general superintendent of the Minneapolis, St. Paul & Saulte Ste. Marie, has been appointed general manager of that road, with headquarters at Minneapolis, Minn., to succeed Mr. F. D. Underwood, resigned. Mr. Pennington has been in railway service since 1869, and was for fifteen years with the Chicago, Milwaukee & St. Paul as warehouseman, brakeman, conductor, roadmaster, superintendent of construction, general roadmaster and assistant superintendent. He was then until June, 1888, superintendent of the Minneapolis & Pacific, and in July of the same year was appointed superintendent of the Soo Line, which position he held until he was made general superintendent on April 15, 1898. It is understood that the office of general superintendent will be abolished.—*Railway Age.*

Senator Depew.

A dinner was given at the Republican Club in New York, last month, in honor of Mr. Chauncey M. Depew, who had a few days before been elected Senator for the State of New York. A great many influential friends of Mr. Depew were there, and eloquent addresses of respect were paid to the newly elected Senator. Among the speakers was Mr. George H. Daniels, general passenger agent of the New York Central Railroad, who said:

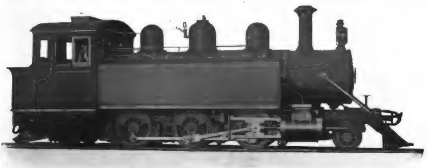
"It is, to my mind, peculiarly fitting that just as this time, when transportation is occupying so large a place in the public mind, not only in this country, but in every country on the globe, the Empire State of the Union should elect as its representative in the most important legislative body in the world a man whose whole life has been spent in the closest association with the transportation interests of the country, and that notwithstanding the prejudice which has so long existed in the minds of many otherwise fair-minded men against railroad officials as such, the representatives of his party have paid a railroad man the unprecedented compliment of a unanimous vote for the most important position within their gift.

"From my boyhood I have been identified with transportation interests, and for the past ten years I have been intimately associated with Senator Depew as chief of one of the departments in the great corporation of which he has so long been the head, and having, like thousands of others, struggled up from the very bottom round of the ladder, I think I may be qualified to speak as one of the rank and file of the great army of transportation employés on the significance of this event; and when I say that I believe it marks a new era in the history of our country, an era of better

understanding and closer and more amicable relations between the great commercial, agricultural and industrial interests and the transportation interests of the United States, I am sure I voice the sentiment of hundreds of thousands of employés of the transportation lines, citizens of this republic, who are doing everything in their power to sustain our government and its institutions, and are assisting in making possible the continued expansion of American commerce."

Ten Wheeler for New Zealand.

The tendency of foreign railway governments and companies to favor the American style of locomotive is well illustrated by the engraving on this page, which pictures one of the most recent locomotives built by the Baldwin Locomotive Works for the Government railways of New Zealand. The engine is for a 3½-foot gage and has cylinders 16 x 20 inches. The boiler, which is 52 inches diameter, provides 1,320 square feet of heating surface and a grate area of 16 square feet. These dimension which represent the steam generating capabilities of the engine are remarkably high. We predict that this type of locomotive will be a grand object lesson to the people in the British colonies who see nothing good in the locomotives turned out of the United States.



SIX-COUPLED DOUBLE-ENDER FOR NEW ZEALAND.

EQUIPMENT NOTES.

The Manchester Works will supply four passenger engines to the Bangor & Aroostook.

The Maine Central have ordered two ten-wheel passenger engines from Schenectady.

The Rogers Locomotive Works are to build thirty-nine engines for the Great Northern.

The Richmond Works are to build fifteen ten-wheelers and Rogers five for the Erie Railway.

The Pittsburg & Lake Erie will get five consolidated engines from the Pittsburg Locomotive Works.

The Intercolonial Railway have ordered five eight-wheel engines of the Kingston Locomotive Works.

Brooks are getting out one six-wheel connected for the Mexican National and fifteen consolidations for the Buffalo, Rochester & Pittsburg.

The Fitchburg Railroad expect four eight-wheel passenger engines from the Manchester Works; two ten-wheel passenger and six twelve-wheel freight engines from Schenectady.

The Chicago, Burlington & Quincy are getting 1,600 new cars, apportioned 500 to the Illinois Car & Equipment Company, 600 to Wells & French and 500 to the Michigan-Peninsular Company.

The Central Railroad of New Jersey are to have fifteen heavy locomotives supposed to be the heaviest road engines east of the Rocky Mountains, carrying about 165,000 pounds on drivers. The Brooks Locomotive Works build them on an efficiency guarantee.

It is reported that the Chicago & Northwestern Railway have ordered thirty engines from Schenectady. The same works have orders for twelve engines for the Kiushiu Railway of Japan, two six-wheel connected engines for the Rutland Railroad and six consolidations for the Southern Pacific.

The Long Island Railroad are making quite an addition to their coach equipment, having ordered thirty coaches and twenty combination cars of standard pattern and thirty coaches for elevated service from the Wason Car Company. They will also soon have eight parlor cars from the Barney & Smith Company.

The Delaware & Hudson Canal Company are getting twenty-five locomotives built; ten by the Dickson Works and fifteen at Schenectady. This company also will soon have 1,500 cars apportioned, 500 to the Union Car Company, 500 to the Murray, Dougal & Co. and 500 to Jackson & Woodin Manufacturing Company.

The Baldwin Works have orders for five six-wheel connected engines for the Chicago & Northwestern, seven consolidated engines for the Nashville, Chattanooga & St. Louis Railway, three six-wheel connected for the Mexican National, and it is understood that they build forty-five engines for the Baltimore & Ohio Southwestern Railway.

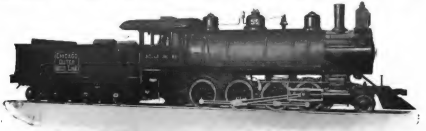
Messrs Gregg & Barrell, Standard Buildings, Joubert street, Post Office Box 938, Johannesburg, South African Republic, desire to obtain catalogs, with prices f. o. b. New York, of all kinds of goods of American manufacture.

The Locomotive Magazine for January, published by F. Moore, 9 South Place, Finsbury, E. C., London, England, is a particularly attractive and interesting number of that publication. Along with it comes a beautifully colored supplement of the historical locomotive, "The Lord of the Isles." There is a fine half-tone of a four-coupled bogie express engine belonging to the Midland of England, an excellent engraving of a Baltimore & Ohio express locomotive and a variety of other attractions that practical railroad men like to look upon.

We have received a letter from Mr. P. M. Kilroy, secretary of the Association of Railroad Air-Brake Men, saying that the Proceedings of the convention held at Baltimore last year are selling very slowly. He says if each member will take it upon himself to dispose of at least two or three copies, he can readily do so. There are Proceedings of other years that are still on hand, and anyone who can stimulate the demand for these will do a good turn to the Air-Brake Men's Association.

Elgin, Joliet & Eastern Baldwin Consolidated Engine.

This is a very powerful and well designed heavy locomotive without any peculiarities which enginemen denominate as frills. The boiler is straight, a good sensible form, and is 72 inches diameter in front. The working pressure is 200 pounds to the square inch. The driving wheels are 51 inches in diameter. Figured by the ordinary rules the engine has with cylinders 21 x 26 inches and driving wheels 51 inches diameter, about 39,000 pounds tractive power. The engine weighs 160,500 pounds, of which 147,000 pounds is on the drivers. This gives a ratio of adhesion of 3.07, and the coefficient of adhesion is 0.32.



ELGIN, JOLIET & EASTERN CONSOLIDATION.

Oil Fuel Clears Atmosphere of Long Tunnel.

In the Austrian State Railways there is a very long tunnel in the Austrian Tyrole, near Arlberg, which was found very difficult to ventilate. We do not know exactly its length, but we were about twenty minutes in passing through it.

As the traffic over the line increased i was found absolutely necessary to guard against the dangers to the men employed on the trains whilst passing through the tunnel at the summit, arising from the fumes and smoke given off by the locomotives burning large quantities of poor coal, and numerous experiments were conducted a few years back to ascertain the effect of burning coal and coke, coke alone, and coal with oil fuel. The oil-burning apparatus tried was that of Mr. Holden, as used on the Great Eastern Railway of England, and the results were so satisfactory that all the engines hauling trains through the Arlberg Tunnel are now equipped with it.

Since the introduction of oil fuel the atmosphere of the tunnel has been perfectly clear, for the exhaust steam is generally soon condensed by its contact with the cool walls and roof, and there is no smoke or unpleasant fumes from the fire. From careful tests made by the Innsbruck University of the air in the tunnel it has been ascertained that when the percentage of oxygen in the atmosphere outside the tunnel is 20.9 per cent. it is only reduced to 19.9 per cent. inside during the continued passage of liquid fuel-burning engines, but it drops to 18.2 per cent. when coal burners are used.

Potentialities of Pittsburg.

In the course of a recent speech, Mr. Andrew Carnegie said:

"There is not a district in this world to which the Pittsburg district cannot today send steel and pay the freight and deliver that steel as cheap or cheaper than it can be made at the point of delivery, if we except Colorado, to which the freight is greater than the difference in cost of manufacture at the two points. Should the South be successful in its present attempt to manufacture steel, we may have to except another point. Colorado excepted, the Pittsburg district has the whole world to-day at its feet. Pittsburg is indeed the steel city. I believe Pittsburg to be the best distributing point in the United States. She sits here, with one wing covering the East, the other the West, her beak dipping into the lakes upon the North, and her tail flapping in the Gulf of Mexico in the South. All points of the com pass are within her easy reach and all tributary to her. She has that surest element of all for success, an enormous home market for her raw products and the largest army of the most efficient skilled labor in the world."

Railway passenger trains of the British Isles are notorious for their want of punctuality in reaching their destination, and a somewhat impassioned discussion has been going on in the engineering papers about the cause of trains being late. It appears there is a Board of Trade rule, known as 145A, which prohibits engine drivers from making up time by running faster than that laid down in the schedule. One of the writers in the discussion says: "The driver has nothing whatever to do with the punctuality of the train. His duty is to start from one station and stop at the next in exactly the time allowed in the working time-book." That appears to be the consensus of opinion of sensible people, but yet there is a tendency to blame the drivers when the train is late. From the experience we have had riding on those trains, we believe that the real cause of trains being late is what seems to be useless delays at stations wrestling with baggage.

Jerry Jackson, the midget engineer of the Chicago & Northwestern Railroad, made a record-breaking run in the first heat of the great fast mail contest between the Northwestern and the Chicago, Burlington & Quincy roads for the right to carry the through mails between Chicago and Omaha. Jerry weighs but 115 pounds, and is less than 5 feet in hight, but the midget drove the giant engine over the tortuous track that winds among the hills and bluffs skirting the Missouri river, in the phenomenal time of two miles per minute. This record was made for the twenty-four miles between siding X and Arion, just before the train dashed into Council Bluffs. This is at the rate of 120 miles an hour, faster than the fastest fast record on the rails in this or any other country. It was faster than the Pennsylvania Railroad's famous performance of August, 1895, when it sent a train 5.1 miles in three minutes, or 102 miles an hour. The New York Central speed record for a short distance is one mile in 32 seconds, or 112.5 miles an hour, made in May, 1893, at Grimesville.

French railways used to be noted for slow speed of passenger trains, but they have been making great accelerations lately. A writer in the *Railway Herald* says: "Some of the French railways are pressing us close. The Northern Railway of France has no fewer than twenty-five express runs timed at 50 miles an

hour or more from start to stop, including one at 57.7, one at 56.3, one at 55.3, one at 54.8, and one at 54.5 miles an hour. In England we have now no run timed as fast as 56 miles an hour, but in Scotland the Caledonian gives us one at 59.1. one at 56.5, and one at 55.6. Admirable time is kept by both these progressive lines—French and Scottish. Would that we had more of this sort of thing!"

Turntable Operated by Air.

At the Grand Trunk roundhouse in Toronto the writer found a rather novel application of compressed air in the form of a turntable operated by this means.

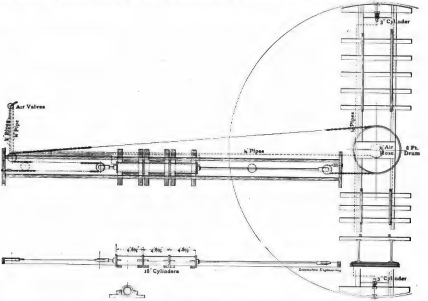
The line drawing makes the operation quite clear, as it shows the 16-inch air cylinder which is, of course, underground and in line with the 8-foot drum on the turntable itself. This cylinder is a trifle over 13 feet 6 inches long, and the multiplying device for the chains at each end of the cylinder enables it to handle the table nicely and give any desired movement.

It will be seen that the operating valve at the left, in addition to being connected with the air cylinder, also controls the small 3-inch cylinders at each end of the turntable which form the latches for locking the table in any desired position.

The operating valve stands upright between the doors, as can be seen from the small half-tone showing Locomotive Foreman Price operating the table. We understand the valve was designed or modified by Mr. William Price, son of the locomotive foreman, who is a bright boy of about fourteen years. Mr. Price also opens some of his roundhouse doors by compressed air, and seems to be looking for more worlds to conquer in this direction.

AIR-OPERATED TURNTABLE.

The turntable itself was designed by Master Mechanic W. D. Robb, who was, unfortunately for us, away during our visit. We are indebted to him for the blue-print, and also for the information that he is equipping two more, one for York and the other for London. The only change is that the air valve for operating is on the end of the table instead of from the side of the roundhouse.



AIR-OPERATED TURNTABLE.

Changes in the Mechanical Department of the Erie.

Mr. W. Lavery, assistant superintendent of motive power at Cleveland, O., has been transferred to New York City, as assistant superintendent of motive power. Mr. Geo. Donohue, master mechanic at Meadville, Pa., has been promoted to be assistant superintendent of motive power, with headquarters at Cleveland, O. Mr. Willard Kells, master mechanic at Huntingdon, Ind., has been transferred to Meadville, Pa. Mr. John J. McLaren, in charge of the motive power at Chicago, has been promoted to be master mechanic at Huntingdon, Ind. Mr. Wallace Macadoris, roundhouse foreman at Brier Hill, Youngstown, O., has been moved to Chicago, to take charge as general foreman. The roundhouse foreman at Niles has been transferred to Youngstown, and a machinist from Cleveland shop takes his place. Mr. Geo. H. Goodell, mechanical engineer of the Erie, has resigned to accept a similar position with the Northern Pacific. Mr. Howard E. Williams has been appointed mechanical engineer of the Erie, with headquarters at Susquehanna, Pa.

Elgin, Joliet & Eastern ... solidated En...

This is a very power... signed heavy locomotive... culiarities which engine... as frills. The boiler is ... sensible form, and is 72 ... in front. The working ... pounds to the square inc... wheels are 51 inches in dia... by the ordinary rules the ... cylinders 21 x 26 inches ... wheels 51 inches diamet... pounds tractive power. ... weighs 160,500 pounds, o... pounds is on the drive... a ratio of adhesion of 3... efficient of adhesion is 0...

Oil Fuel Clears Atmos... Tunnel.

In the Austrian State R... a very long tunnel in the ... near Arlberg, which wa...

...ficult to ventilate. We do ... ly its length, but we were ... minutes in passing throug...

As the traffic over the ... was found absolutely nec... against the dangers to th... on the trains whilst ... tunnel at the sum... fumes and smoke ... motives burning ... coal, and numerou... ducted a few yea... effect of burning ... alone, and coal ... burning apparatu... Holden, as used ... Railway of En... so satisfacto... trains thr... now equip...

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...ppear in ...led "Hill ... together ...s strug- ... progress ... in the ...etails of ...ng, but ...y have ...acts of ...l does ... has he ... taken ...l, that ...erence ... Balti- ... a se- ...lection ...ry to ...n re- ...ce of ...ore & ... with ... that ...lf in ... h... ...erty ... with ...an ... the ...ar a ...

after the train, which was starting, and suddenly the man darted ahead and caught the last car as it was pulling out, leaving the woman yelling, crying, and probably swearing, in a vain endeavor to catch the train also. She didn't get it, however, and

SCOTCH BLOCKS IN POSITION ON THE GRAND TRUNK RAILWAY.

A NEAT STATION SIGN ON THE GRAND TRUNK RAILWAY.

CANADIAN PACIFIC LIME CAR.

was finally pacified by the station officials. It looked like a plain case of "shake," and ... he carried at least half of the ...

...es of Train Service.

...eeland, president of the ...d Club and president of ... Railway Company, is ...tor, but he is one of the ... and humorous speaker, ...ned to. In the course of ... travel, punctuality of ...ention, etc., Mr. Vree-...

...marks about the neces-...e recall to me an anec-... days on a railroad not many miles from here, when I was conductor. Trains were not accustomed to making schedule time, and there was a change in the management. The new general superintendent came to the engineer when we got into the terminal. We were late and he said, 'Can't you make the time of this train?' 'I can't without tearing my engine all to pieces, sir,' said the engineer. 'Well,' said the superintendent, 'you tear "your" engine to pieces, and we will give you one that belongs to the company I want this time made.'

"I remember an incident that happened to me a few years ago. I was engaged in superintending the construction of a very large overhead trolley system near here, and the manager, who was very anxious to have the syndicate see how rapidly he was pushing the work, asked them to come and take a ride over the reconstructed line. He said it was reconstructed in part, but they could get along nicely. We all got into a private car. We rode about half a mile and got out and walked some distance; there were no special horse cars in the intermediate points, and this was kept up all the morning. We rode probably one-third of the time on the electric road, another third of the time on horse cars and walked the other third; and one of the gentlemen at lunch that day, speaking of the experience, said it reminded him of the story of the Irishman who was in a foreign country and they wanted to show him some consideration, so they invited him to take a sedan chair, carried by a couple of coolies. It was richly adorned, but as he stepped in the bottom fell out. Off they started, and he ran along with the coolies the whole distance. When he arrived at his destination, they asked him how he liked that method of transportation. He said if it wasn't for the style, he would a great deal rather have walked.

"The only experience your Chairman has had in connection with foreign railroads was the Intercolonial. I had occasion a few years ago to go to the extreme end of the Dominion in connection with some coal interests we had there, and I traveled on the Intercolonial road, which, as you know, is run by the Government. We had very fine equipment. There were the various classes of carriages. The manager of the properties was a member of the Provincial Parliament, and was with my party. We had a buffet lunch in the regular American style of drawing-room car. When it came near night, he asked me if I would not like to take my wife out and have dinner. We accepted, and at a place near Grand Narrows stopped. He said, 'You'd better put on your wraps.' We assumed we were going into the station restaurant, but rode a mile down to Grand Narrows to a hotel, went in and were compelled to register. We took off our things and sat down to a regular dinner. We had scarcely seated ourselves comfortably when they tried to hustle us

off again. This gentleman said, 'Don't be in any hurry; they will not go until we get through.' We took our time and went out and had a cigar with the proprietor of the hotel. We went off on a branch line with a five-car train some five miles into a point of land. They unloaded the baggage and passengers, and I was in the rear car and stood by the rear door, with no trainmen there at all, and they backed that train five miles at the rate of thirty-five miles an hour to the junction and then took us to our destination.

"I stayed there about a week. I wanted to leave on the following Monday, and somebody in the office said there was 'a rumor' that they were going to change the train time, and that I had better go and find out about it. I got the manager to telegraph to Quebec. It was the only way to find out. This was Saturday morning, and the answer came: 'We think we will change on Monday.' On Saturday night at 9 o'clock the train came in, and I went to the depot and asked the conductor of the train who came in if the time was to change. They had been leaving at 10 o'clock in the morning and getting in somewhere around 9 o'clock at night. He said, 'Yes, the time is going to change Monday, and the train leaves at 5 o'clock Monday morning.' On Sunday night we took our trunks and went to the depot. They had a sleeper there. The baggage room was locked. It was impossible to do anything with the trunks. We got into the sleeper, but it was necessary to have the tickets countersigned by the agents at that point. I asked the porter of the car to do it. He said they were not allowed to do it under the rules. I asked him what I would do. He said I would have to get up and have the tickets countersigned. I said, 'Can't you do it?' He said, 'No.' I said, 'Suppose I don't do it?' He said, 'You will have to pay your fare.' I said, 'I will pay you to have it done, and if you can't, I will pay my fare; I will not get up at half-past four in the morning.' After all this fuss, we arrived at exactly the same time as the train did when it left at 10 o'clock in the morning.

"There was one place where we had to cross a piece of water about as wide as the East River, where the passengers and baggage were transferred, and there were about 50 minutes allowed for the transfer We did it in ten. I asked one of the trainmen when it was that it took that length of time. He said in some cases in winter there is a good deal of ice there, and it takes a good while to get across.

"My limited experience with railroads away from home is that the construction, maintenance and equipment, fencing and everything of that character are very good, because in order to secure the Government subsidy the work has to pass the inspection of the Government engineers, so that the road there, in its rails, roadbed, fencing, buildings, shops, warehouses and everything of that character are better than the average road with us; but so far as the general arrangement for operation or transportation is concerned, I was not particularly impressed with it.

"While, as I have said, it has not been my good fortune to have had an opportunity of personally observing the delights and peculiarities of transportation abroad, I have at second hand, from returning engineers and railroad men, received no end of news and information on the subject, and the most interesting items in this yearly-growing budget concern urban transportation, a branch which, as you know, on account of my unfortunate official position, I am at times compelled to hear a great deal about. Much of this news, knowing the boastful character of railroad men just returning from abroad, I take with salt, and while I know very well we in America have the finest city transportation facilities in the world, it was not until very recently that I believed the rest of the earth was so far behind us. I was converted to a full belief in what observers had told me by no less an authority than the London *Morning Post*, that pale-white sheet of British conservatism.

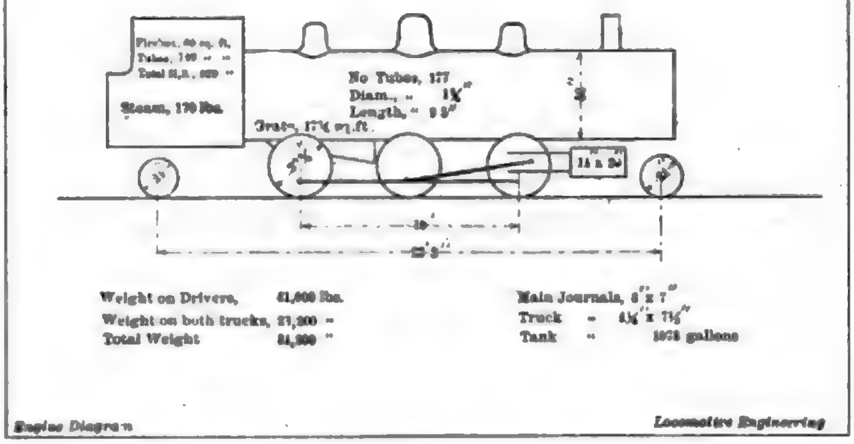
"I want here to make public apologies to the American travelers whose tales I was so cautious about, and at the same time rebuke them for their economy of truth. Let me read you what the *Post* has to say about one of the railroad systems that the Municipal Controllers want us to copy and struggle up to.

"'Though only a part of the new Viennese Metropolitan Railway,' says the *Post*, 'has been opened, complaints of the treatment of the public on the part of officials and the management appear in the newspapers. The German mind appears scarcely to have yet conceived the notion of a railway in any other light than as a medium for the imposition of oppressive regulations. There is a fine for getting into the wrong train, there is another for having no ticket, another for riding with a ticket unpunched, and another for presuming that you are getting out at the proper station when you have as a fact already passed it. Mitigating circumstances are inadmissible in this list of offenses, and the culprit is promptly ordered out of the carriage to be summarily brought before the inspector on the platform and fined there and then without the opportunity of making any effective protest. A woman passenger has already been made a sacrifice to this delightfully interesting system. The ticket was unpunched through no fault of the trembling culprit, a policeman was fetched, the woman taken prisoner and not released until she paid a fine of five shillings. The worst feature is that the woman has no redress.'

"I am told, too, by the happy ones who have been there, that the transfer system of Paris leaves nothing to be desired by men and women who have time to enjoy it. I understand that there, when you get out of a 'bus and want to transfer to another, they number you, and when your turn comes, you can take conveyance if there is a seat vacant. While waiting for this happy accident to occur, I have been informed, frequent opportunity is offered to read two succeeding editions of the evening papers. I am frequently implored by editors and other well-informed persons, to go abroad and see how easy it is to furnish everyone with a seat, and I once had a nightmare, during which I put the numbering system at work in New York. It was a wet night, and the traveling public was in a frenzy of delight over the improvement."

Baldwin Six Coupled Double Ender for Government Railways of New Zealand.

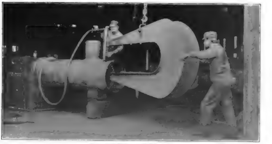
Gauge 3'6"



After a lengthened report and discussion on the relative merits of the single and double exhaust nozzle at the Central Railroad Club the conclusion arrived at was that there was no difference so far as economy of fuel was concerned. It is a case of you pay your money and you take your choice.

Pneumatic Riveter.

The Boyer pneumatic riveter, here shown at work, is the latest production of the Chicago Pneumatic Tool Company. The dimensions permit very heavy work to be done, as it has 8 feet depth of gap on boiler work. The photograph from which the engraving was made was taken at the boiler shop of John Brennan & Co., Detroit, Mich., where the riveter is in everyday use, operating very successfully and satisfactorily. In operation, the rivets were put in from the outside and headed against the dolly bar on the inside, thus bringing the rivet heads up in line and all alike, and producing that regular appearance of straight lines so desired by the boilermaker. This riveter is in use in boiler, locomotive and railroad shops in this country. and has recently been introduced to the European market, where it is meeting with great favor. The riveter can be attached to frame of any style or depth of gap desired, and can be used on all classes of work, as it will very successfully drive rivets up to 1¼ inches in diameter. Its operation is very rapid, and by the users has been considered superior to hand work.



PNEUMATIC RIVETER

The Cook Cooler Company, of Flint, Mich., manufacturers of the Cook car journal cooler, have just closed a contract with the Chicago, Rock Island & Pacific to equip its entire system with their device. This cooler has now been on the market for about two years, and has made rapid progress. It has gained favor with a number of roads, and we understand that several others contemplate making it standard.

One of our correspondents referring to the difficulty encountered lighting headlights on a windy night, says: "If there was a small door in top of headlight large enough for a man's arm, I feel safe in saying I could light a headlight running thirty miles an hour. Some of the oldtime headlights have small doors in them yet for lowering or raising wick. Why not agitate it and have them put on top?" We regard the suggestion as a very good one.

There are certain persons who are intensely anxious to see underground railroads built in New York City, and all sorts of arguments are employed in favor of that kind of urban roads. Among the arguments is one to the effect that the operation of underground railways would not be interfered with by fog. The people who use this argument ought to ride in the underground railways of London on a foggy day!

As a rule, English people are intensely opposed to the use of American expressions, especially those that have originated on this side of the Atlantic. We find, however, in the last few years, they have adopted without question our verb to double-head a train. "Double-heading" is a more compact expression than "two engines hauling the train," and accordingly has been quietly adopted.

What is now the largest ship in the world was launched at Belfast last month. It is for the White Star Line and is called the "Oceanic." The vessel is 704 feet long and 68 feet broad and 49½ feet deep. The gross registered tonnage is 17,040; the displacement is 30,100 cubic feet; the horsepower 28,000, and the calculated speed is 24½ miles per hour.

In a recent lecture before the students of Purdue University, Dr. Dudley, chief chemist of the Pennsylvania Railway at Altoona, Pa., said that it cost nearly as much for stationary with which to carry on the business of the road as it did for iron.

A small illustrated catalog has been published by the Buffalo Forge Company, illustrating a variety of engines made by the company.

Growth of the Passenger Car.

It was not till about the beginning of last century that coach builders first began to swing the coach bodies on straps to soften the jolts. That practice was at first denounced as enervating and destructive of British hardihood.

The wheeled coach did not come into use without oppositon. A coach with two or four horses pulling it might make a fine display, but for comfort, said the sensible dame, give me the sedan chair. The sedan chair held its own in some quarters up to railway times.

Two parallel bars, called trams, were used in primitive times to carry loads, the motive power being two men, one at each end. That was called a hand barrow. With the growth of luxury and laziness, certain people wished to make themselves the loads. The primitive method, probably, was to put a board across, which made a seat for the rider. By degrees it developed into a covered box, called a sedan chair. For many centuries that was the means by which youth and beauty in all parts of the globe were transported to balls, fetes and fashionable outings. It still holds its own in Oriental countries, where it probably originated before the time when Egyptians or others thought of putting a box on wheels to make a vehicle.

There has been a great deal of controversy about the origin of the word "tram," that has become so much used in connection with the word "tramway." Certain Englishmen claim that it comes from Outram, an engineer who was intimately connected with the development of early British railroads, but the claim is absurd. Parallel rails were called trams centuries before Outram was born, and the name probably originated from the occupation of the man who walked outside the trams and drove the horses pulling a plow. Nearly all the languages in Europe have the word tram, and had it before the name of Outram was ever heard of.

In his "Inventory" Burns, who lived before Outram's time, says:

"An auld wheel barrow, mair for token,
Ae tram, an baith the legs are broken."

The tram played as important a part in early railway rolling stock as it did in giving luxurious people the means of conserving their personal comfort. When someone discovered that by arranging a double line of iron rails wheeled vehicles could be run over them with less frictional resistance than was possible with the irregularities of the best roads, the old-fashioned pair of wooden bars were saddled with a strong box and called a wagon. The trams extended beyond the box and made bumpers.

When the growth of railways arrived to call for the carrying of passengers, the pioneer railway engineers in Great Britain put hackney coach bodies on the trams and formed the early passenger coach.

There was something curious about this, for when the first railway to permit passengers to be carried in England began operating the passengers were accommodated in a vehicle that resembled an omnibus, with seats at the side door and at the end. This vehicle was pulled by a horse.

When it was decided to pull passengers behind a locomotive engine, it was seen that more than one vehicle would be needed to form a load. The engineers of the day were in a quandary, for they did not see how people could get over the bumpers to enter the end door, when more than one vehicle was on the train. So they settled the matter by abandoning the omnibus for the hackney coach form of car body, with doors on the sides.

American ingenuity hit upon the end platform as a means of developing the omnibus form of car, and all other parts of the railroad world are now showing practical regrets at having started off wrong.

All railways in Europe that I am acquainted with started out with four classes. They tried to accommodate all the class prejudices and to provide compartments for the different castes. It was very distasteful for a nobleman to sit beside even a monied plebeian, and as late as 1847 the exclusive gentry used to have their family carriages put on a flat-car, and rode there in solitary grandeur. Several accidents happened to these carriages, such as getting thrown off the train and taking fire from sparks thrown by the engine. It was found that the practice caused too much risk, so pride bowed before safety and the nobility took to riding among other people.—*Angus Sinclair, at New York Railroad Club.*

Mr. Clement F. Street has resigned the position of manager of the *Railway and Engineering Review,* of Chicago, and gone to Dayton, Ohio, as manager of the railway department of the Dayton Malleable Iron Company. Mr. Street was formerly chief draftsman of the motive power department of the Chicago, Milwaukee & St. Paul Railway, and has been connected with the *Review* for the past seven years, one year of which was devoted to a trip around the world in the interests of the Field Columbian Museum.

Commenting on the appearance of our January number, *Transport* says: "Looking through the brilliant pages of this Phœnix-like issue, I cannot refrain from indulging the notion that one or two other contemporaries might benefit from the destruction of their offices by fire.

"Graphite" is the name of an attractive little paper published by the Joseph Dixon Crucible Company, of Jersey City, N. J., and devoted principally to telling about graphite products and the people connected with them.

Persistence of the Compartment Car.

The foreign railroad and engineering journals abroad devote so much space and attention to illustrating and describing long corridor cars, which are merely American vestibule cars, that a stranger would imagine that truck-carried long cars were becoming as common in Europe as they are with us. The man who never sees anything beyond six feet radius of his own nose, on arriving at Liverpool, is ushered into a first-class salon car which compares favorably with those found in our first-class trains.

The hackney coach style of car has developed considerably since it was first introduced, but the great mass of the people in Europe travel in that kind of car, and prefer it to any other. It is known as the compartment car, and is entered by side doors, the seats being secured across the car, one row of passengers sitting with their face to the engine, the other sit backing up. To those accustomed to European prejudices, it seems strange that in Europe most of the people prefer to ride with their backs to the engine.

The compartment car has many drawbacks, and to the traveled man no merits over our day coaches, unless it be that by tipping the guard a shilling or two you can obtain a whole compartment to lie in during a short journey. There is practically no heating of the cars, no lavatory accommodation, and you are liable to be closed in with very disagreeable people, who may rob or murder you with impunity before help could reach you.

Whenever any particularly gross outrage happens in a compartment car, there is a newspaper screech against railway companies for not providing corridor cars, but the agitation soon subsides, and things go on as they were.

To people accustomed to traveling in this country, the hardest ordeal, in making a five or six hours' journey during cold weather, in an unheated train, is the suffering from cold. When people are accustomed in daily experience to endure low temperatures, a cold ride does not seem to incommode them, but when they are in the habit of living in a comfortable temperature cold brings misery. I have taken my turn in snow-bucking amidst Western blizzards, and considered that trying hardships were endured in that kind of work, but the most miserable experience I ever went through was one night in September in passing through the Austrian Tyrole. It merely happened that in the high altitudes a cold wave and snow-storm struck the train, and as I had no overcoat or cold-weather clothing, I had to endure losing sensation in my feet and watching my nose get blue with the cold.

The question is constantly coming up, why do railway companies in Europe persist in using these inconvenient compartment carriages, when they have been shown how much more comfortable a corridor car is?

Conservative influences are all powerful in European countries, but railroad managers there do not stick to the compartment car because they are against change. The nature of their business makes them too shrewd for that. They do not want to change because for a given dead weight a compartment car, supported by two or three pairs of wheels, will carry much more paying weight in the form of fare-paying passengers than one of the heavy bogie-carried corridor cars will do.

A six-compartment car weighing 10 tons will seat 60 passengers. That is about 373 pounds per passenger. A corridor car 50 feet long, which has part of its seating capacity taken away by the aisle, will weigh about 20 tons and seat about forty-five people. The weight per passenger in this case is about 900 pounds, and may exceed that.

In early days railway companies all over Europe catered principally to first-class passengers, but they soon got over that, especially in the British Isles. First-class passenger fares are considerably higher than they are with us, and the luxurious accommodation provided greatly increases the dead weight per passenger. If the third-class car, which carried sixty third-class passengers, had been arranged in first-class compartments, it would have given accommodation to thirty-six people, and the dead weight per passenger would have been 622 pounds, as compared with 373 pounds.

The huge consolidation locomotive which was built by the Pittsburg Locomotive Works for the Carnegie roads, and which we illustrated in our November issue, is giving great satisfaction in service. The company's yards were chronically blocked with cars until this huge engine went out. Three days' work was sufficient to clean up the yards, and the engine hauled such a great weight of cars that there is no more likelihood of blocking the yards.

We notice in the Proceedings of a recent railroad club meeting, that some members expressed themselves in favor of safety coupling chains even for freight cars. It might be possible to make a safety chain trong enough to withstand the shock of the main coupler letting go, but we have never seen it demonstrated We regard the safety chains as useless nuisances for train men to swear over.

The average age of a freight car is said to be about twelve or fifteen years. A coal jimmie may be considered a freight car with increased responsibilities. The life of a jimmie is about as uncertain as that of an ass, but half a century may be taken as a fair average.

Portable Boiler Tester.

It is generally necessary to run a locomotive on a certain track in the roundhouse, or at least very near to it, in order to have the boiler washed and tested. In the Northern Central (now a division of the Pennsylvania system) roundhouse at Elmira, they reverse the operation and carry the tester to the locomotive. They have a steam line running to nearly every stall, with a drop pipe between the tracks, to which the Rue "Little Giant" boiler tester is coupled as shown. This is mounted on a truck and carried to any desired track to be used.

The idea is a good one, but there are objections. When steam is carried any great distance, it is sure to condense, even though covered by insulation, as in this case, and wet steam isn't a good thing for any injector, but is particularly bad for a special instrument such as is necessary

PORTABLE BOILER TESTER.

for this work. In this particular case the pipe is a little small also; but the scheme is a good one, and with better provisions for dry steam and plenty of it, there will be little difficulty in carrying out the idea.

An Erie engineer, Mr. Arthur O'Hara, has invented a car brake that exerts its retarding effect through friction of the brake shoes on top, or top and sides of rail, through a system of levers carried on the truck frame.

We are frequently moved to exclaim "What is fame?" when the name of some celebrated man is misspelled. All the world has heard of James Watt, the famous improver of the steam engine. One of our contemporaries recently published an item saying that a certain professor of engineering had delivered a lecture on James Watts.

The Crumlish Forge Company inform us that the demand for the Crumlish forges has increased so that they have been obliged to seek larger quarters, and have removed to 18 and 20 Elk street, Buffalo, N. Y.

The Q & C Company will remove from their present offices in New York, at 100 Broadway, to the corner of Liberty and Church streets, ground floor, where they will have offices and salesroom combined, carrying in New York a considerable stock of machinery and tools of their own manufacture. One advantage of the new location is that the offices are diagonally across the street from LOCOMOTIVE ENGINEERING.

A discussion is going on in British engineering papers about the economy of heating feed water by live steam. It looks to us that the opponents of the practice have the best of the argument.

Early Methods of Traveling.

The following are cuttings from a paper lately read before the New York Railroad Club by Angus Sinclair:

In the childhood of the world people were satisfied to walk, but they soon got over that healthful practice. History tells us not when mankind first began to make animals carry them, but it was a long time ago. Riding on the back of an ox, or an ass, or a horse came to be regarded as easier than walking, but the world was not very old when new inventions of locomotion were resorted to.

Those who have seen certain carvings taken from buildings which were erected in the dawn of history will have noticed that as far back as human records go war chariots were used in triumphant processions. But it was not for war alone that wheeled vehicles were used in those early days. We read that Jacob and his family were transported to the land of their adoption in wheeled wagons, and that on Joseph was conferred the honor of riding in Pharoah's second chariot.

It was a long jump from the time of Jacob to that of Julius Cæsar, but there seems to have been little progress made in carriage building through these long ages. The Romans, with all their push and progress, did little or nothing for the wheeled vehicle, except to make it a little larger and perhaps stronger. It was still made wholly of wood with wheels turning with the axles, and had a strong resemblance to the rural wagon to be seen in Mexico to-day.

The Romans were better on roadways than on rolling stock. They left Europe netted with splendid roads that afterwards seemed to stimulate succeeding generations to improve the vehicles to travel over them. Between Cæsar and Charlemagne were 700 years of nearly chaos, yet carriage construction had made decided advances.

Carrying war supplies and men was no doubt the principal object in improving the carriages in middle ages.

War ideas have helped to push ahead the mechanic arts. Iron molding was developed in the casting of cannon, and blacksmithing in forging mail and armor. It is, then, not surprising that it helped to improve the wheeled vehicle.

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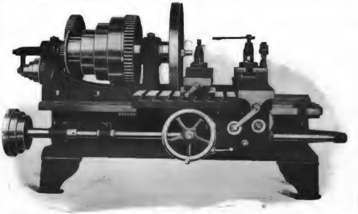

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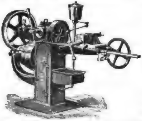

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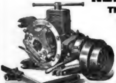

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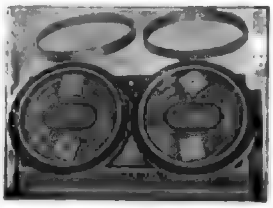

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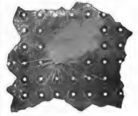

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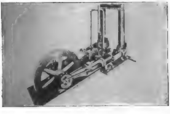

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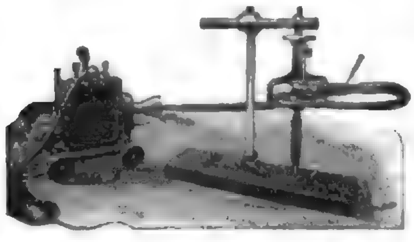

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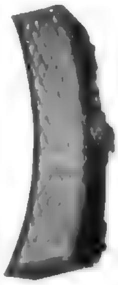

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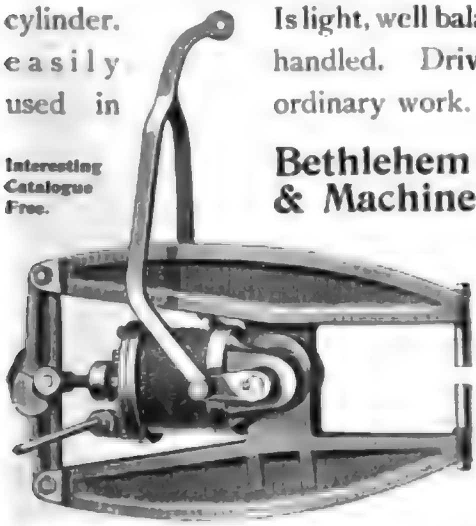

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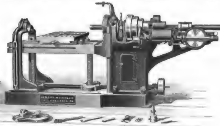

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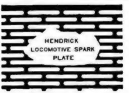

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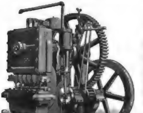

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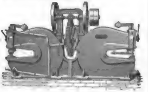

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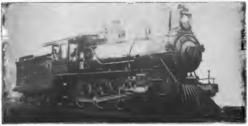

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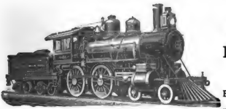

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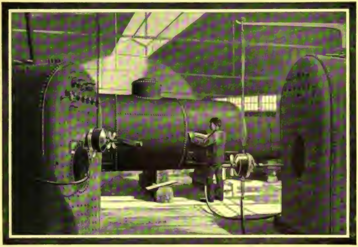

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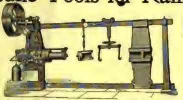

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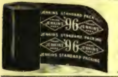

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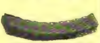

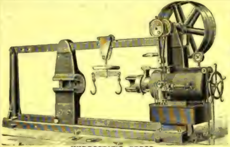
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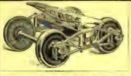
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Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XII 95 Liberty Street, New York, March, 1899 No. 3

Types of Russian Locomotives.

THE LOCOMOTIVES OF THE ST. PETERSBURG & WARSAW RAILWAY.

This tandem compound passenger engine of the St. Petersburg & Warsaw Railway has only been lately turned out of the Poutilovsky Locomotive & Machine Works, near St. Petersburg. This locomotive, as one can perceive by the photograph (No. 1), is one of the latest master-pieces of Russian engineering, the Assistant Minister of Ways and Communications, Mr. Petroff, having himself taken part in its designing. We may venture to say that this engine is destined to become a standard type on the Russian State railways, as sixty-seven locomotives have been ordered from the Poutilovsky Locomotive & Machine Works, of which thirty are intended to reinforce the rolling stock of the St. Petersburg & Warsaw Railway. The results of the trials were very satisfactory. The train consisted of nine cars, eight of which were of the bogie system.

TANDEM COMPOUND, ST. PETERSBURG & WARSAW RAILWAY.

The total weight of the train, with engine and tender complete, was 343.1 tons, and 245.5 tons without engine and tender. The trial took place between St. Petersburg and Pskov, a distance of 256.1 versts (170.7 miles), and the average speed was 72.82 versts (48.54 miles) an hour, 102.86 versts (68.57 miles) an hour being the highest speed attained.

Before this locomotive came in, the fast passenger service was performed by a type of compound locomotive built by the Kolomensky Locomotive & Machine Works, near Moscow. This type was brought out in 1891. The locomotive proved satisfactory in all respects, but as some of them were sent to the Great Siberian Railway, the company ordered the type as represented in Fig. 1. The engines were fitted with Wenger's automatic brake (now changed for the Westinghouse brake), steam sanding apparatus, speed indicator and two whistles, one of very loud tone, resembling a steamer's whistle, which was to be used in the open country, and the other of soft tone, for use in stations. This type of compound engines was quite a novelty on the St. Petersburg & Warsaw Railway. The driving wheels were much larger than in the former ones, and these engines were intended for fast service only.

An older type of Russian locomotive still doing excellent work on the St. Petersburg & Warsaw Railway, for slow and local passenger service, is represented in Fig. 3. They were built in 1871 by the Alexandrovsky Locomotive & Machine Works, near St. Petersburg. But as they could not draw the fast trains of the continental service, they were replaced by the Kolomensky type of engines.

A still older type, but not of Russian workmanship, exists on the St. Petersburg & Warsaw Railway, which is in very good condition, and is represented in Fig. 4. These engines were built by the A. Borsie Locomotive & Machine Works, in

Berlin, and were turned out in 1863. In 1893 they were fitted with the Westinghouse brake gear, which is now supplied on all the company's passenger engines. The tenders are all the six-wheeled type. The fuel of all these locomotives consists of wood, in which Russia is very rich in these provinces. In the Polish provinces the fuel is coal, and the funnels are therefore like the Kolomensky & Poutilovsky type. NICHOLAS SMIRNOFF.

St. Petersburg, Russia.

PASSENGER LOCOMOTIVE, ST. PETERSBURG & WARSAW RAILWAY.

American Cars in Egypt.

The Westinghouse Electric & Manufacturing Company are equipping a trolley line to Cairo, Egypt, with fourteen cars of the regular type. After the natives become accustomed to the newfangled dromedaries, the line will be extended to the pyramids, and later to Alexandria.

The Schoen Pressed Steel Company is also to send 400 steel cars to the Soudan Railway. Surely trade follows the flag of civilization, regardless of the country it represents.

A new book of rules took effect in the operating department of the eastern district of the New York, New Haven & Hartford on January 1st. Some of the divisions had been using green signals for safety and some white. The new rules prescribe red for "stop," yellow for "proceed with caution," and green for "proceed." Signals are being changed to conform to this. The rules as to train rights on single track have also been made uniform on all divisions. Now "at points shown on timetable for meeting of trains running in opposite directions, trains will wait indefinitely for opposing trains of the same or superior class." That is rather an odd rule and is likely to cause delays, but it is likely to prevent collisions.

Tribulations of a Roundhouse Foreman.

BY ROBERT H. ROGERS.

"I have often extricated myself out of many difficulties by my knowledge of mathematics and big words," said the man of railroad reminiscences, recently, "and it may be that I have studied human nature a bit. I have bluffed my way through some seventeen or eighteen different occupations and have made a success of them all after a fashion. The hardest thing I ever did, though, was to bluff through the job of a roundhouse foreman.

"You don't know much about the duties of that position, do you? Well, you are just as well off. I had my hands more than full at the time, but now that it is all over I can look back to a time when I had more sport than at any other time in my career.

"I was a lucky man on the K. C. & B. system from the start. When I went there to serve my time as an apprentice machinist I had an auspicious start. My second cousin was president of the road, and my family knew directors and stockholders innumerable. I believe that they would have fixed up a scheme to make me a machinist in a year, had I not insisted otherwise. I was fly enough to know that if I did not serve my full time I would be the subject of more or less caustic remarks from my subordinates during my later years with the company. I was slated for great things after I was free, and I was determined to go through that long period the same as any other apprentice did. Of course, I didn't care how fast they promoted me after that.

"They were a tough old four years, however, and vastly different from what I had pictured. I thought that a machinist's work consisted in wearing clean overalls and a white cap and posing gracefully over the tail stock of a lathe while a big cut peeled off.

"As I said I found it all different, very different. I was unfortunate enough to be sent to a roundhouse to serve my time, and had it not been for the glowing future held out to me by my friends, I believe that the first day would have let me out. A roundhouse is certainly a disenchanter to a novice. Both in winter and in summer it is equally bad. In the latter the thermometer climbs up to somewhere around 140 or thereabouts, while you are lying over the high boiler of a hog with the lagging all burnt from under the jacket, trying to pack one of those new style throttles, and with the skin peeling off your fingers from contact with that labyrinth of red hot lubricator pipes which it is seemingly impossible to avoid. Also in the front end taking out steam pipes; it is better imagined than described. As for the winter season, the least said about it the better. The coldest object in the world this side of Ivigtut, Greenland, is a cold locomotive being repaired on a roundhouse track in winter. The hot ones just in from the road are little better. I have chipped at least five inches of ice off pedestal brace bolts before I could get at them to tighten them up.

"When I went to work the men in the shop didn't seem to take much stock in me because I was of rather a better class, and they doubtless thought that I was a snob. I was so green that I didn't even know how to dress myself for the job that I had undertaken, and well remember that I came to work in a box chinchilla coat and patent leather shoes. This was on my first day, and I think that the effect produced by that costume lasted throughout my apprenticeship.

"There was an engine on the drop pit at that time, put in for back boxes. A drop pit is not ordinarily as clean as the boudoir of Mrs. Eustace Fitzherbert, but I think without exception that we had the worst on the system. The said pit was not a hydraulic pit by any means, but one of those primitive affairs with a screw jack thread in each corner, worked by a brake wheel taken from the top of a gondola or flat car. Of course I was assigned to the drop pit gang, and also to a wheel to pull. It is also safe to say that I will never forget it. There are tricks in all trades, and those other men had the art finely developed of running their three wheels down in unison, leaving me to lower all the weight with my wheel, assisted by a pinch bar as big as myself, between the spokes.

"We had an engine on that pit every day, and that crowd had lots of fun with me. Of course every engine which we went to work on in the mornings had to be finished. Every machinist knows what that means. Before we left there that night it had to be ready for the road. I guess in the five months that I worked

on the drop pit I went after all the impossible tools ever conceived of. I have hunted half-round squares innumerable, smooth files and left-hand monkey wrenches without end, but I eventually lived it down. The master mechanic had received his instructions to give me all the show possible, and in the third year of my time I found myself working as a machinist with a helper. Of course they picked the work for me as well as they were able; but that didn't suit me; I wanted to do everything. I learned to set valves, and insisted that I should set them. The consequence was that the road was strewed with wrecks and old iron from busted straps and eccentrics, and the best of the rolling stock was going over the system with exhausts like a three-legged dog. I no doubt learned how to set valves, but I had my own original ideas about the matter, and that is what spoiled it. I was great on experiments, and, in that particular line a departure from an old-established standard don't go. It was a lucky day for the company when I was free and decided to leave the shop.

"Following out the schedule laid out for me by my friends that I should learn all the branches before taking hold of the big job they had selected for me, it was absolutely necessary that I should fire for a time on the road.

"This was another experience. I had never had a shovel in my hands when I was put out one cold winter night on a hog with fifty hoppers in tow, over a division where it was up hill both ways, and so crooked that you couldn't use straight air. Of course I was out learning and the regular fireman was along. I fired part of the way, a very inconsiderable part, however. It didn't make much difference, as the engineer had received his orders to turn me in on our return. I think that my firing on that trip consisted in raking out the ashpan when we stopped and pulling around the penstock to take water. I also remember that I dug down some coal from the back of the tank as soon as the pile had crawled that far from the fireman. When I did attempt to fire I think that I succeeded in hitting the ring around the hole seventeen times out of twenty. All things have an end, however, and the trip finally wound up. The master mechanic asked me if I could fire by myself. I told him that I could bust the 'dome.' He then asked Pat Collins, the engineer, and he told him that I might make out.

"So when the '1220' was called again I wrestled her myself. That was a peach trip. We were twenty-eight hours getting over a seventy-five mile division, and stalled eleven times. One time the steam was down so low that there wasn't enough to ring the bell, and, as far as the temperature of the water in the boiler compared with shaving water, it wasn't in it for a minute. I believe it was his fault, though, that we failed the first time. I mean the engineer. We were going up a hill about nine miles long, the first by the way of the run, all the others we doubled. She had a firebox twelve feet long, and, with the bar in the corner and the throttle in the last notch of the rack, the draught was rather strong. I had all the hair burnt off the backs of my hands, and it seemed that every shovelful that I would ladle into her I would receive it the next moment down the back of my neck. If I hadn't held on to the scoop I believe it would have been jerked out of my hands against the front flue-head in a jiffy. Well, we had about 150 pounds on when we butted against the elevation I have mentioned. Pat dropped his seat and came to the back door of the cab to encourage me:

"'Bale it into her,' he said. 'You can't get too much in.'

"He didn't know me, however. I was a big strong buck in those days for a collegian, and I accordingly redoubled my efforts. The consequence was that I did get too much in. Presently the needle commenced to go back like an alarm clock running down. I gazed at it absolutely appalled, not knowing where it would end. It finally rested at 70 pounds, and naturally the old mill stopped. The interior of the firebox presented a curious spectacle. All the fire was sloping from the door up to the tube sheet, leaving only about half the flues uncovered. In other words I had 'balled' her, or 'blocked' her, whatever you choose to call it, but it was amply sufficient. We were standing still about fifty minutes, I think, as the sequel to this incident. After dropping the grate and building up a new fire, that is, Pat did, we got under way again. About three miles further up the slope I accidentally knocked down the arch with the long rake, again complicating matters. Oh, that was a great trip. The head brakeman fired the remaining thirty miles, and I laid off at the other end, returning home in a parlor car.

"I think that I slept for a week after reaching home. When I reported for work I was informed that I was to go to Holesburg as roundhouse foreman. Then the fun commenced in earnest. Of all the tough places I have ever come in contact with, Holesburg was the most adamantine. It was the terminus of two divisions, with the trainmaster's office a stone's throw from the shop; so if you know anything at all about the road you can imagine what this means to a foreman. He was in the roundhouse all the time, and would ask for the engines before they were landed on the ashpit.

COMPOUND LOCOMOTIVE, ST. PETERSBURG & WARSAW RAILWAY.

"There were available about thirty engines for the freight service, and at least forty trains. Sometimes they would want nine sections on a run, and about the extent of the work which could be done was to pack a driving box cellar. The worst of all, however, was the scarcity of material. The company was economizing at that time, and hadn't bought any material for six months. It used to be laughable to me to walk around the shop and see the men trying to file brasses with files so smooth that they would have to sand their shoes to keep from falling on their faces when they pushed them. There were no headlamp chimneys, and it was a common spectacle to see engines going out on the road at night with a handlamp stuck up in the headlight box. Towards the last it got so bad that I had to commence to run the rakes and shovels first in first out.

"My greatest trouble up there was with one engineer who made my life a misery. Generally there is one individual of this

cian who is a crank and the bane of the unlucky foreman on whose division he happens to be. In my case his particular hobby was on his valves. They were never right. It was 'valves set' and 'valves examined' on every work slip he would make out. Sometimes they weren't 'square,' sometimes there was 'an odd beat' somewhere, but invariably the engine 'wouldn't run down a hill,' and if 'two snails were put in a field with her, one would get away.' This is the kind of stuff which he rubbed in on me. I had every man who knew how to hold a tram go over his valves, and I was assured that they were all right and that the alleged defect was only fancy on his part.

them myself and I will adjust them by mathematics.'

"I could see that this statement had him because he looked much more respectful. He left, and bright and early the next morning I went around to the '846' with a tram, the gang and the whole layout. As I expected, I found after going over the whole business that she was all right. The hooks were evenly divided, the lead was exact at all ends and she cut off within an eighth of an inch all around. Immediately after this examination, in which not a nut was slacked off, I took a piece of chalk and ornamented both steam chests and each side of the smokebox with all the old algebraic formulas learned

PASSENGER LOCOMOTIVE, ST. PETERSBURG & WARSAW RAILWAY.

"But it didn't do any good. He would lose time on purpose to queer me, and daily I was besieged with such queries as these from the superintendent: 'Please explain,' and 'Can you tell us why?' 'Engine 846 must be put in condition,' and so on *ad infinitum*.

"I was nearly distracted between the correspondence and the constant kicking of the old duffer. I believe I lost twenty pounds of weight before I found a way to extricate myself from this dilemma which was threatening my job. I found out by accident that this chap was a great respecter of things which he didn't understand, and I finally sawed him off by a very neat bluff game, such as I have told you before, that I have frequently used to advantage.

"One day he came in off his run and incidentally reported that he wanted his valves set. I pulled myself together and said:

"'Well, Hen, everybody around the place has been fooling with your valves, and because they have set them by the old plan they have missed it. To-morrow before you go out I am going to run over

in college which I could possibly cudgel from the innermost recesses of my brain.

"This work had just been completed when my tormenter appeared. It would make a mule laugh to see the reverential awe in which he gazed at the formidable array of *x* plus *y* over *z*, sandwiched in with astronomical formula and the signs of the zodiac.

"'My God,' he finally gasped, 'was she out that bad.'

"'Out that bad,' I replied, 'I don't see how you got over the road at all.'

"'And what did you change in her.'

"'Come around on this side,' and I led him to the left where there was even a more startling opium dream delineated.

"He sized the collection up like one thoroughly familiar with the subject, and as he climbed up on her to unlock the boxes he said:

"'I think that she will be all right now.'

"Well, would you believe that he went out on that run, the longest and hardest on the road and actually made up eleven minutes on a belated schedule. When he came in no words now can do justice to his profusion of metaphor in trying to describe how very much better the old '846' had become. Where before she wouldn't 'run down a well,' now he could hardly keep her from running from under him, and so on. And all this without a tap being struck, except the *x y z*.

"I solved many of my difficulties this way, but of course I couldn't do them all; but in line with the old policy, you know, I was promoted as soon as it got too hot for me."

Manly Way of Advising Firemen.

In a circular letter sent to all the firemen on the Denver & Rio Grande along with a copy of LOCOMOTIVE ENGINEERING for December, describing the method of firing followed on the Burlington, Cedar Rapids & Northern, Mr. C. H. Quereau, master mechanic, says:

"I know, from personal experience and observation, that the method of firing as described in this article is practical, and will give the results stated. I ask you to read the article carefully and put it into practice.

"I do not expect you to change your present method of firing all at once, but hope that gradually you will work into the system on which the article is based. If you do not succeed the first month, or even the second, if you will keep on trying, I am certain you will be pleased with the results. After you have experimented for six weeks or two months, I would be glad to have you call and tell me your experience, or write to me."

Business does not seem to be in a very satisfactory condition in Chili, so far as wage-workers are concerned. One of our subscribers in that country writes us: "Last June the Government called in all the gold and silver currency, which was 18-pence dollars, and issued fifty millions of paper money, which has fallen to 12 pence to the dollar. This has made a big reduction in our wages, for everything has risen in price from 30 to 50 per cent. Wages here for passenger engineers are $5.50, freight men $5.27 per day, and the different branches of shops by mechanics from $3 to $5 per day. You will see from this that when the money is converted into United States gold dollars, that it takes a good deal to pay for a year's subscription to LOCOMOTIVE ENGINEERING."

There once was a locomotive engineer who had a peculiar way of testing the tendencies of new firemen. He would tell the firemen to fill the oil cans and then watch how the work was done. If the fireman filled the cans in a careful manner, watching to see that no oil was spilt, he was judged as a promising man for advancement; if he permitted the oil to run over and make a mess, he was judged fit only for some other occupation and was treated accordingly. Young candidates for advancement in the cab would find this a hint worthy of attention.

Roundhouse Chat—About Oil Records.

BY R. E. MARKS.

I s'pose every roundhouse has its characters, queer ones too—and our old shanty isn't destitute in this respect.

There's Jim Johnson, a young engineer who is doing good work, but who is one of these fellers that would swear anything was good if it was only new. One of these red stack men, if he thought it was a new red or a new stack, either one.

Tom Timmins is just the opposite. He's always croakin' for the "good old days" when he used to work nights and Sundays on repairing his engine and get $70 a month for it; he's drawing over a hundred now. If you have any old scheme you want to try, just get it put on Tom's engine, tell him its old, and it goes if Tom has to push it.

Then there's Uncle Billy Baker—in the oil room now, Billy is. Eyes went back on him and he couldn't see signals good, so they gave him an easy job for life. Uncle Billy began railroading in 1856 and has been at it ever since. More than that, he hasn't forgotten all he saw day before yesterday, as most men do. Fact is, Uncle Billy Baker has the best memory of any man I ever met. He can tell you the day and hour when such a thing happened, and knows more about the peculiarities of the engines on this road than the men who run 'em every day. Once in awhile Uncle Billy calls some of the men down when they begin splurging about what they're doing, and he and Jim Johnson often scrap over something or other—and Jim is usually wrong.

We used to think Uncle Billy was drawing on his imagination considerably in going into details of old engines, but I looked up a few cases and found he was right. Now I've come to think Uncle Billy is about as near infallible as they make when it comes to memory.

Jim Johnson got the oil-saving fever the other day, and was telling us all in the roundhouse how he had made forty-five miles to a pint of oil with his engine on freight. He's running a ten-wheeler that is just out of the shop and in good condition.

"S'pose you don't believe that, Timmins," he said, "or else you used to do a darn sight better before the war?"

"Now, Jimmie, can't say as I did. We didn't have no fool notions about oil when railroading *was* railroading, back in the sixties. Darn me if I don't believe you burn more coal running an engine shy on oil than all the oil costs, let alone what you save. If you save coal and oil too, that's different, but the combination don't go, generally. And repairs, well ask any repair man where they've had a fit of savin' oil. If I had my way I'd put a barrel of oil on every tender with a sign 'Use all you want.' What do you think, Uncle Billy?"

"Well, Timmins, I don't quite agree with you, no more do I with Johnson when he thinks he's doing so smart with the No. 119. She's just out of the shop and orter do well. I believe there's lots of oil wasted, mostly by being run on the ground 'stead of in the oil holes, and some kind of a can like Skeevers told about in LOCOMOTIVE ENGINEERING some time ago will probably save a heap of oil in a year. I don't believe in wastin' oil, but I do believe in usin' plenty. But—," and here the old man drew out a blue-print from his pocket, "when you talk about oil, here's a little interesting stuff I ran afoul of up in Scranton last fall, and got the draftsman to pull me a print. You know I used to run there and I was interested in the engines. It's a monthly report for December, 1861, showing cost of repairs and a lot of other things, but just let's take oil.

"Now here's the 'William E Dodge,' one of the Danforth & Cooke engines, 18 by 24, 39 ton 800 weight, 10-wheel coal burner. Mary Tiffany ran her then—59 miles and a fraction per pint of oil. Then there's the 'Moses Taylor,' 50½ miles; 'Mehoopany,' 58 miles, nearly; 'Pennsylvania,' 53 miles, and 'C. R. Roberts,' 53½ miles—all practically the same work and engines 'bout alike, only the 'Roberts' burned wood. The 'Monockanock' was a Rogers, but same as others, 58½ miles. Among the passenger engines were the 'Col. Scranton,' 17 by 22 inch engine, with 66-inch wheel, 60 miles and over, and the 'Aquanshicola,' 17¾ by 22, ten-wheeler, wood burner, 77 miles.

"There's a lot more given, some lower for various reasons, such as shifting and other things, but the average for the whole batch for the month is over 46 miles per pint of oil.

"This isn't any fairy story, Jim, jest got up to down you, for you see it's a regular report and has Watts Cooke's name at the bottom, and we wasn't trying to save oil specially neither."

I don't know whether Jim Johnson really believes those reports are correct or not, but it's evident they are, and it makes quite a mark for our boys to work to. I don't think the old fellows knew it all, but we do find some pretty good performances and ideas among the old records and drawings, and Uncle Billy seems to be loaded for bear on most points.

COMPOUND PASSENGER LOCOMOTIVE, ST. PETERSBURG & WARSAW RAILWAY.

Uneven Wear of Pistons.

Mr. Symington's letter on "Wear of Cylinders," on page 74, February issue, speaks of the wear being in different parts of the opposite cylinders of the same engine, and gives three reasons for this peculiar action which are very good.

There is another point connected with this matter of which he does not speak. The writer has seen a good many sets of cast-iron snap rings worn so thin where they rubbed against the top of the cylinder, that they were taken out as no longer safe to run, while at the bottom the tool marks had hardly worn off from them. The opening in these rings was at the bottom, so that the "bull" or riding ring made the joint steam tight.

As these rings were free to move up and down in the piston head, improper lining of the guides, or any lost motion there allowing the piston to move up and down, could not affect the wear of the rings, which we could reasonably expect to be greatest at the bottom.

The weight of the rings would naturally tend to hold them on the bottom of the cylinder all the time; and the stiffness with which they set out, to which should be added the pressure of the steam getting

in behind them, would be even all around the bore of the cylinder.

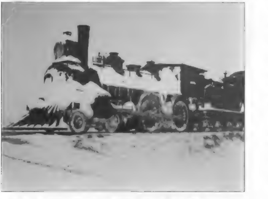
Now, the question comes up, Why should these packing rings wear faster on top than at the bottom of cylinder?

It may be that the question of oil lubrication cuts some figure.

At the top of the cylinder next to the live steam in the steam chest, it would be hotter than on the sides and bottom. This would leave the top dry; the bottom and sides would be moist and in a measure lubricated with condensed water. In the case of insufficient lubrication with oil at this point, the dry surfaces would wear faster than the moist ones, and the packing rings would show it.

How do the practical men who have to meet these questions look at this?

as fast as it can come in from the boiler; this keeps the pressure about uniform in the cup. In addition to this equalization of pressure with the boiler, there is something else needed. The opening through the choke plug must be so small that when the steam is shut off from the steam chest while the engine is running, and a partial vacuum is formed in the steam chest and oil pipes by the action of the piston, the amount of steam passing out of the cup from the boiler pressure into the partial vacuum will not be enough to change the rate of feed of the drops of oil. These chokes vary in size in the different makes of lubricators; most of them are about 3-64 inch. Possibly the choke plug openings in your cup are too large, or the steam pipe from boiler to cup may be too small.



A SEASONABLE APPEARANCE. FROM PHOTO LENT BY B. OF L. E. JOURNAL.

Plain Talks to the Boys.

BY C. B. CONGER.

SIGHT-FEED LUBRICATORS.

So you would like to hear about the troubles with sight-feed lubricators, instead of talking about firing coal, as we arranged at last meeting? Well, all right, we want to talk about the subject that will interest you most. What particular part of the lubricator do you want explained?

Why does the cup feed so much faster when the engine is shut off than when working steam?

In answer to that question, in the first place, if the cup is to feed regularly at all times, the steam pressure inside the cup must be regular; that is, the pressure must not vary suddenly. When the engine is working steam, the pressure inside the cup in each part of it is the same as in the boiler, and the pressure in the oil pipes is the same as in the steam chest. Where the oil and steam pass out of the cup into the oil pipes, the opening is contracted by a nozzle or choke plug, so that the steam cannot get out of the cup into the oil pipes

A large supply pipe from the boiler to the top of the cup is absolutely necessary for regularity of feed. If you wish to prove this, close the steam valve between the boiler and top of cup, so that very little steam passes into the cup, and observe its action. You will see that when the throttle is opened the cup will stop feeding for an instant; when the throttle is closed it will feed very fast for an instant without regard to the size of the chokes. If the steam is taken from a turret which has injector and other steam supply pipes coupled to it, so that boiler pressure cannot be maintained in the turret, your cup will not feed regularly. Look at all these points mentioned and you will likely find the cause of your trouble.

What is this we hear about a cup not feeding into the steam chest when the throttle is open wide and the lever cut back close to the center?

Well, there is a good deal to it.

Some years ago it was thought that idea was not backed up with facts; but nowadays it is believed as gospel. This change of opinion was brought about by putting a gage glass in the oil pipe at the top of the steam chest and observing the action of the current of oil, steam and water passing through it, when the engine was shut off and drifting; and the other condition, when working steam with wide-open throttle. Of course when running shut off the oil, steam and condensed water going out of the cup could be seen passing through this gage glass towards the steam chest. But the instant the throttle was opened and pressure rose in the steam chest, the opening from steam chest being full size of oil pipe and the one from the cup being only the size of choke plug, the oil pipe would fill up from the steam-chest end, driving the oil and water flowing down through the pipe back towards the cup generally within a few inches of it. The gage glass in the oil pipe would fill up with clear water from the steam chest. This water could not then run out of bottom end of oil pipe against the pressure in the chest any faster than its place was supplied at the top end of the oil pipe through the choke plugs. By actual test it sometimes took forty-five minutes for the oil to show passing through the gage glass, especially when full pressure was maintained in the steam chest with a wide-open throttle.

How can this be remedied? you ask.

Well, there have been several remedies devised that we will speak of. In the first place, if a sufficient supply of steam can be allowed to pass into the top end of oil pipe, so as to allow a free current down through it at all times, the oil will pass down to the chest as fast as it comes out of the cup.

Now, enlarging the chokes would do this, but that would interfere with the regularity of the action of the cup. It might be feeding all right at one time, and shortly after feed so fast that it would be nearly empty when noticed. In these later days, when so much account is taken of valve oil, that would not do at all.

The plan of putting the choke plug in the steam-chest end of the oil pipe has been tried. An objection to this was the fact that if this choke got stopped up, there would be no way of getting oil through this pipe to the valves, and very likely the first notice that it was stopped up would be a cut valve.

There is a method of placing this choke at the steam-chest end and making it variable, so that it is open large when engine is working steam, so oil will pass down freely; and closed up small when shut off, so feed will not be too fast. This is said to work very well. Where the choke plug is placed at the steam-chest end, of course boiler pressure is in oil pipes steadily the same as in the cup.

Another plan tried was to admit an additional supply of steam from the boiler into the oil pipe near the cup when the engine was working steam, and shut off this supply of steam when the engine was

shut off. Of course this device had to be automatic, for men on the engine have other duties to perform. When this automatic valve does not close at the same time throttle is closed, it will admit steam to chest, so engine is likely to move—in fact, it is the same as a leaky throttle.

Then there is another remedy for the trouble which is to connect another pipe to the oil pipe at top end; this second pipe to be supplied from the dry-pipe pressure, which would allow a good circulation down the oil pipe and in through the second pipe. This method works well, as it aims to equalize the pressures at each end of the oil pipe from the top end instead of from the bottom end.

"Is this difficulty of getting the oil to the steam chest steadily any more with a boiler pressure of 200 pounds than with a lower pressure?" you say. That is hard to prove. Engines carrying very high pressures are harder to lubricate than those with lower pressure for various reasons. The friction under high pressure may be more, while the higher temperature tends to vaporize the oil before it has done good service.

With any sight-feed cup working under the usual conditions, when the engine is shut off, all the oil and water in the pipe goes down into the steam chest, so that every time the engine is shut off, the valves get what oil the cup is feeding. Also, if the pressure is very much lower in the steam chest than it is in the cup, the oil will pass down the oil pipe. This is because there is a greater flow through the chokes when the pressure is very much greater in the cup than in the oil pipes, so that if the engine is running under check, the oil goes down all right.

If the engine slips when working hard on a grade, and you shut her off long enough to let the oil pipe empty itself, she will get oil at that time.

You will see from this talk that if the chokes are too large, the cup will not feed regularly: too fast when engine is running shut off, and the chokes may admit steam enough to start the engine after she has been stopped. This is dangerous. On the other hand, the small chokes keep the oil from passing down the oil pipe after it has left the cup on its way to the steam chest. It feeds up through the glasses all right and into the top end of the oil pipe, but does not go down to the valve when engine is working with a wide-open throttle and short cut-off.

Now has this been made plain to you? If not, please keep right on asking questions when you want to find out about these matters. LOCOMOTIVE ENGINEERING expects to help you.

The Father of the Steam Engine.

The queer looking apparatus shown in the annexed engraving has little resemblance to the modern steam engine, yet it possessed all the leading elements from which a successful steam engine was developed. By that remark we do not mean to imply that the machine shown was not a successful steam engine, for it was; but it was an extremely crude engine to use for the conversion of heat into mechanical work.

Twenty-two hundred years ago the center of scientific research and learning was Alexandria, in Egypt, then under Roman control. There is reason to believe that the philosophers of that city had made some advance in using the pressure of steam for various purposes. But they did not discover the means of harnessing that wonderful power to perform useful operations. They appear to have been familiar with the principal elements that They had discovered that by filling a vessel with steam and then condensing it a vacuum was formed which would suck up water a distance of about 24 feet. Then pressure direct from the boiler was applied to the vessel containing the raised water and by this means it was lifted to another level. It was a very crude arrangement, but it was superior to horse power for the drainage of deep mines.

Engineers familiar with heat problems will understand that the waste of heat in these operations was enormous. Experimenters had tried putting a piston in a cylinder to receive the steam pressure, but they did not seem capable of devising working connections for the piston. The

THE FATHER OF THE STEAM ENGINE.

afterwards were employed to make a commercially successful steam engine, but they never understood the combination that put the elements into working order.

From the time this era began until within three centuries ago there were very few scientific men, and the few that existed had other things to attend to that seemed of more importance than working out a new motive power. But as war became less and less the principal avocation of mankind, leading minds began to devote their attention to put the forces of nature to the service of mankind. During the seventeenth century various savants were speculating on the possibilities of utilizing the force of steam for industrial purposes, and about the end of that century various crude attempts were made to employ steam for raising the water out of mines.

Nearly all the experimenters of that time were, however, on the wrong track.

genius to perform this stupendous advance was found in Thomas Newcomen, a mechanic of Dartmouth, England, who designed many engines of the kind illustrated. He built an engine with a cylinder and piston, and connected the movement of the latter by means of a walking beam, with a pump that drew the water out from the mine. It was a very crude affair, but it was superior to anything previously tried for pumping purposes, and had wide-spread application in the British Isles before Watt improved it by applying a separate condenser. In the Newcomen engine a jet of water was injected into the cylinder to condense the steam which created a vacuum, and the atmosphere pressing upon the top of the piston pushed it down and completed the stroke. At first the weight attached to the pump-rod was sufficient to counterbalance the piston and send it to the top of the

cylinder. In later engines steam was used for that purpose.

There are many men still living who remember seeing Newcomen engines at work, and it is probable that some of them are still pumping water in remote places where coal is cheap.

We are indebted to Mr. Harris Tabor, of the Tabor Manufacturing Company, for the photograph from which this interesting old relic was made. He picked it up in Manchester, England, during a recent visit to that city.

Highway Crossing Signals.

A general superintendent tells a story of one of the stockholders who accompanied him on an inspection trip, and asked what the posts set up along the road and marked with the letters W and R were used for. He was informed that they were to call the attention of the engine men, so that the whistle would be sounded and the bell rung when coming to highway crossings.

This did not appear to make the matter any clearer, for his next remark was that W was all right for (w)ring, but he could not see how they would get R in for whistle.

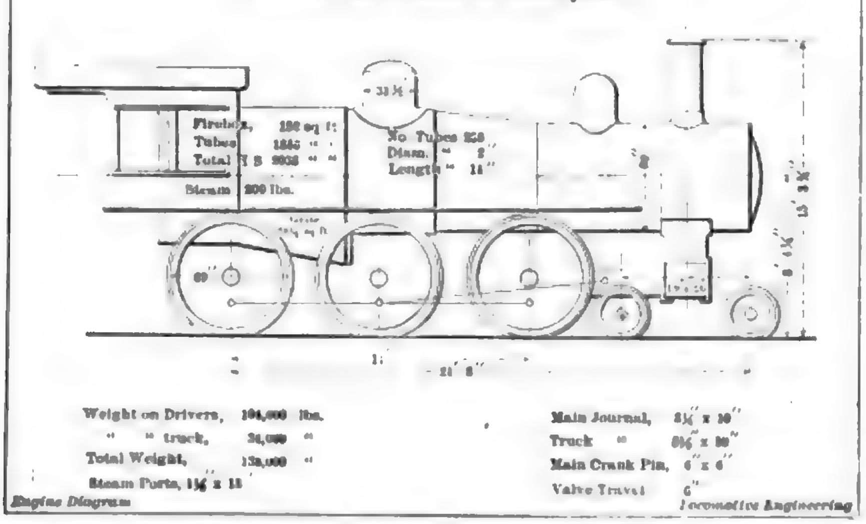
While the question of orthography may not have very much to do with this subject, yet it sometimes seems that the matter of signals for highway crossings is as confusing in its real significance as the posts were to our stockholder friend.

In a fair proportion of these United States it is required by law that certain distinct signals be given from a locomotive when approaching "highway road crossings at grade," and if within the limits of cities, the sounding of the whistle is prohibited, but ringing the bell is made compulsory. A great many railroads have a clause in their rules requiring the engine bell to be rung steadily while the engine is in motion.

The standard train rules provide that "two long, followed by two short blasts of the whistle is the signal for approaching road crossings at grades," and it is further provided that "the engine bell must be rung before an engine is moved," and that "the engine bell must be rung for a quarter of a mile before reaching every public road crossing at grade and until it is passed; and the whistle must be sounded at all whistling points."

Now, we would understand from these rules that it is an important matter; yet there are many roads that do not assist in having it complied with, by locating whistle posts as reminders to the engineer. There is no doubt that they aid in the matter, for when these whistling posts come into the range of an engineer's vision, it gets to be a habit for him to reach for the whistle handle and give a signal, sometimes according to the code; at other times the sounds instead of being separate and distinct are run all together.

Richmond Ten Wheeler for Plant System.



There is not enough attention paid to the fact that the signal should be given according to the law and rule if it is a lawful notice to anyone about to occupy or cross the track, that a locomotive is close upon them. It is not enough that a noise be made to attract the attention of the passer-by. The signal should be given so that it will be a legal notice. It should also be given so clear and distinct that it cannot be taken for a "break in two" signal or any of the other ones in the code.

But it is with the bell that the greatest deviation from correct practice comes in. Some of them are located back so close to the cab that the sound of the bell drowns all other signals given by the voice, so that when the engine is moving through crowded yards the bell is held still so that signals can be heard across the cab. A bell so located is rung very little, and its use as a signal is limited. An engine bell looks nicer back next the cab where the steam dome is ahead, but as it is intended to give signals and not for looks, it should be where it will do the work best—next the stack. On the wide fireboxes of the Wooten type, the bell comes behind the engineer's cab. There does not seem to be any other convenient place to locate it; but does it serve a good purpose of warning persons on highway crossings? To do that it should be so located that the sound will go ahead of the moving train.

The question of good bell ringers, of which there are plenty in the market, applied to each bell and kept in order, is a pertinent one, for the fireman has very little time to ring the bell if he attends to his other duties properly.

In case of a person or team being struck on a highway crossing it is the custom of the litigants on one side to prove that the signals were given, and on the other to deny it. If whistling posts are put up wherever needed, and good bell ringers attached to bells located so that they can be heard ahead of the train, it will help to change an uncertainty to a certainty that proper signals were given, and warn passers-by that it is dangerous to cross, thereby saving life as well as discouraging litigation.

Six-Coupled Double-Ended Locomotives for New Zealand.

A group of locomotives of this type was recently ordered from the Baldwin Locomotive Works for the Government railways of New Zealand. That is a highly popular kind of locomotive for our friends in the Australian colonies, and they no doubt do very good work in hauling trains short distances at speeds that do not call for excessive piston speed. With the frame tank they have great help in making the adhesion satisfactory, and the simplicity of the mechanism makes the engines easy to keep in good working order.

We have been favored with two of the lettering charts being made for draftsmen by L. L. Leisher, 351 Vermont street, Buffalo, N. Y. They consist of Bristol board ruled with both heavy and light lines, and so spaced that any size letter, from one-sixteenth of an inch to an inch and a half in hight, can be obtained. These are placed under a tracing in any desired position, and the rulings form an accurate guide for lettering, both in hight and width. There are two charts, one for vertical and the other for italic lettering. They should be very useful to any draftsman who has much lettering to do.

The peculiar condition of snow shovelers getting more money than engineers and firemen is said to have existed in several of the large cities in the recent "bliz." The snow had to be removed, and as high as $4 a day was paid in some cases. It's simply a case of supply and demand, and the men benefited by the demand.

General Correspondence.

A Curious Result of a Wreck.

The cuts below show a steam chest of an 18 x 24-inch Schenectady engine recently in a wreck on the A. T. & S. F. Ry., at Burrton, Kan.

The engine after being brought to shops was stripped, and when the cover of the left steam chest was removed the chest on one side was found to be completely filled with oak timber, broken and splintered in such a manner as to look more like wood pulp than anything else. Cut No. 1 shows where timber must have entered and also the terrible force with which it must have been driven. The point of entrance was very small, the timber spreading out and filling the entire inside of the chest and breaking no part of it other than that shown in the cut. Cut No. 2 shows top of chest after removal of cover; timber directly under cover as even and smooth as though planed off. This curious result of a wreck will perhaps never occur again; in fact, one may be safe in saying it will not.

This chest has been placed in the engineer's reading room at Topeka, Kan., and is drawing a very great deal of attention from all classes of railway employés.

M. P. Gregory.

Topeka, Kan.

FIG. 2. CURIOUS RESULT OF A WRECK. FIG. 1.

The Pool System and Railroad Economy

Believing the so-called pool system to be against the best interests of railroad companies and the men in charge of engines and the men running engines, I shall presume to open a discussion on the subject, which I hope will bring out the views on both sides and give us a fair comparison of the advantages and disadvantages of the system. In the first place, I wish to state most emphatically that I am uninterested in the matter, except to see the road with which I am connected run on economical lines, believing that we are more apt to receive a better compensation if the cost of maintenance is reduced to the minimum.

Let us take for an example a road or a division of a system having 200 engines and 800 miles of road, 250 engineers and 250 firemen, making a mileage of 400,000 per month. It will take eight inspectors, machinists, boiler makers and air men to inspect those engines, and then only half as well as the engineers would do it without compensation. Allow the inspectors $2.50 each per day, and it amounts to $20 per day, $7,300 per year. A boy putting supplies on engines at $1.25, or $456.75 per year.

All master mechanics know and expect that the cost of repairs will be greater under this system; and we believe that the smallest amount that could be figured as increase on that account for 200 engines would be $1,000 per month, or $24,000 per year.

The fuel in all cases will be the largest item, and I know of a road that made 24 miles and a fraction per ton for 1897, and the same road fell to less than 20 miles per ton in 1898, the change in the system of running engines taking effect January 1, 1898. This, in round numbers, cost the company 3,334 tons of coal, at $2.50 per ton. This would amount to $8,335 per month, or $100,020 per year. If this had been a Southern or Western road, where fuel costs $4.50 per ton, it would amount to $179,916. So if it is poor policy for a road paying $2.50 or less for fuel, it is still poorer policy for roads paying $4.50 or upwards.

The oil suffers still more than the coal under the pool system; but as it does not prove as large an item in dollars and cents, we will not attempt to compute the amount. But from the conclusion drawn we have:

Cost of inspection per year........	$7,300
Engine supplies per year.........	456
Extra cost of labor in making repairs per year.................	24,000
Extra cost of fuel, at $2.50 per ton, per year..................	100,020
Total....... ....…	$131,776

Supposing a new engine to cost $8,000, this would buy 16½ engines per year, and in twelve years it would buy an entire new equipment of engines.

Now why will the pool system never be successful? To get good work from a number of men, there must be some incentive, besides the money consideration. If we can get them on a competitive basis, that is all that is necessary. When a gun club goes out to shoot at a mark, there is a prize given, and everyone shoots his best. If every man runs his own engine and the blueprint is carefully kept, any man with pride will shoot his best and try to be near the top of the list. When he gets there he feels that he has accomplished something, and he tries to maintain his record; while the men further down the list feel that their ability is in doubt, and they must put forth a greater effort.

Some of the advocates of the pool system say all engines of a size and build are alike, and a man can do as well with one as the other. The writer used to think so, too, but has long since been convinced to the contrary. Each engine has its weak points and its strong points. The regular engineer does, or should, know them; a man on a hundred engines never will. Show me an engineer who favors the pool system, and I will show you a man who is an engineer in name only. He is afraid to enter the competitive list on his merits, or he is too lazy to keep his work up, or doesn't have the ability or skill to keep up his engine, and thinks he is in luck to have someone do it for him.

Two years ago we were advancing. Our engineers were working on their merits; they were figuring on combustion, economy in oil; they were studying valve motion and air, and were watching all points to sustain their record or make a better one. The engineers that we were beginning to feel proud of, will in five years be known in history only.

One of the arguments in favor of the pool system is that the company now own the engines; that the engineers get more work out of them, etc.

This, however, is not the case, and the fact of the matter is they never could get

as much work, let alone more out of an engine.

A racehorse to win a race must be in the pink of condition. A machine must be the same. A machine or a locomotive is more apt to give trouble unless well taken care of, and the old saying that "What is everybody's business is nobody's business," holds good in the pooling case, and the perfect machine soon degenerates. If the company wants certain time made and a certain tonnage hauled, let the traveling engineer take a train over the road for an example, and every engineer on the road will duplicate his performance or die in the attempt. He will also key his own rods, set up wedges, tighten up loose nuts, pack the throttle, put in water and lubricator glasses, clean his headlight, pack the cocks in the cab and the air pump, keep the engine neat and clean and always ready to go out, if it lies in his power. None of these things are they now doing, but are ready and willing to do, and more, if given back their engines. Then if the conductor asks the engineer if he can make his meeting point, he confidently says yes; whereas under the pool system he don't figure much on what he can do until he gets in.

Believing this to be a vital question of policy and economy, I would like to see it discussed from all standpoints by those in transportation as well as in the mechanical department. DAVID DAVIS.

Keying up Main Rod.

In December number Mr. Rich says he agrees with nearly everything Orange Pound has said on the subject of keying up main rod. I cannot agree with Mr. I. B. R. I cannot agree when he says the proper place to key main rod is on the quarter. I claim the proper place is on either the upper forward eighth or the lower back eighth, and I think both practice and theory will bear me out. However, we will see who is right, I. B. R. or I.

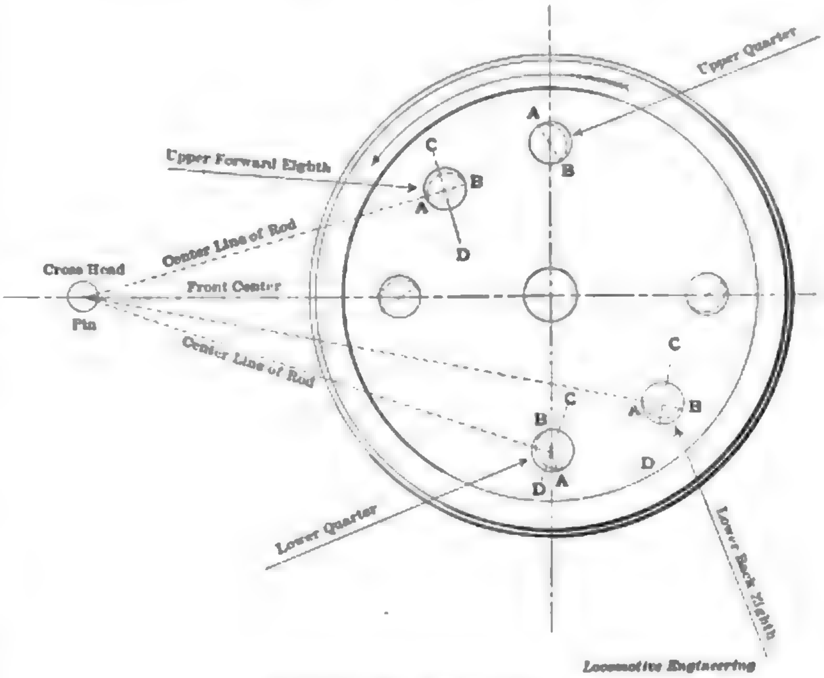
In the accompanying drawing I have shown on a magnified scale the wear on the pin by the dotted lines. The solid line represents a perfect round pin, while the dotted lines a worn pin. Now we will key up the rod on the bottom quarter as I. B R. claims is the proper place. The dotted lines *A B* show the greatest diameter of the pin, new or old. If the brasses (the dividing line between the two halfs being *C D*) are keyed snug on either quarter they will be keyed on a diameter of the pin which is not its greatest diameter, and when the engine is moved so as to bring the pin on the lower back eighth or on the forward upper eighth, at which points the greatest diameter of pin will be at right angles to the dividing line C D, between the brasses, the brass will pinch the pin and the result will surely be a hot running journal and a continual annoyance. But if the keying is done on either the upper forward eighth or the lower back eighth it will be done on the greatest diameter of the pin which is at right angles to the dividing lines, between the two brasses, and as a consequence the brasses cannot be keyed so as to at any point pinch the pin.

I agree with I. B. R. that a rod should never be keyed on the center, and if Orange Pound claims the center as the proper place to key it he must have gotten the side rod and main rod badly mixed up.

I. B. R. claims that with the pin on the quarter and ports covered the conditions are always the same, even for a new pin. As far as the conditions of the ports are concerned, it is all right, but are the conditions of the pin always the same? I think not, and if I. B. R. keys up a badly worn pin on the quarter he will find out that the conditions of a new pin and those of an old one differ very much, while the conditions in connection with ports may not change.

T. J. HANDERSON.

San Francisco, Cal.



POSITIONS FOR KEYING MAIN ROD.

Handling the Schenectady Compound.

In view of the diversity of opinion expressed in January number by the several engineers who are handling Schenectady compounds of the latest design of valves, it occurred to me that an interested reader would be justified in some modest opinions of his own.

The instructions relative to their operation in case of break-downs was extremely interesting, and I would like to be permitted to add my mite to the store of information relative thereto; but before I do so, I want to ask what kind of oil should be used in this oil dash-pot of the intercepting valve that we are cautioned so particularly to keep well filled.

I would like to explain that the rapidity of movement of the intercepting valve is regulated by a plug-valve located in a by-passage, which connects the two ends of the dash-pot cylinder. This valve is clearly shown in the illustrations of the Schenectady intercepting valve in January LOCOMOTIVE ENGINEERING a year ago (1898). A slight opening of this by-pass valve causes a slow movement, while a wide opening makes a too rapid movement of the intercepting valve.

Here is another question (this letter of mine seems to be in the form of a catechism with the questions unanswered and the answers unquestioned—as yet): What prevents the intercepting valve from turning half around so as to close the opening from the receiver to the separate exhaust valve?

Mr. Bruce, in the January number, advises the removal of the cap and the blocking of the separate exhaust valve open, if desired to run simple and the separate exhaust valve leaks away too much air. Several of the compounds of this design that I have seen have two connections to the operating valve in the cab, so that the air can be shut off and steam used in its stead. Hence, I was led to suppose that all engines of this class had such arrangement, in which case it would be a loss of valuable time to do as he suggests.

I call all compounds that can be run as simple engines at the will of the engineer convertible compounds, as distinguished from automatic compounds, or those which, immediately after the first stroke or two, automatically change to compound working, and remain so as long as the engine throttle is open; and I would advise any

man interested in the handling of these convertible compounds to examine the valves and valve seats whenever a chest cover taken up gives him the opportunity. He will thus find if the seat is in the center of the chest or not, and ascertain the point where the "Allen" ports (if any) are open to the exhaust. Having this information, he would know at once where to block the valve on the disabled side in order to open the exhaust port.

And it should be understood that, while good power can be developed with these convertible compounds on one side, but little speed is obtainable. A 2-inch pipe will supply the low-pressure side, it is apparent, at only slow speeds; and it is equally evident by a glance at the beautiful (I should have said lovely) chart we all received with our new subscription, that the separate exhaust valve will give but a very small exhaust opening to the high-pressure cylinder, should occasion demand that the engine run in with that side alone. Hence it is that I say, to obtain any speed with these engines the exhaust port on the disabled side should be uncovered, either by means of the "Allen" ports in such a valve or preferably by moving the valve to whichever extreme position will give the greater exhaust opening, if possible so to do.

I notice Mr. Burke says the low-pressure cylinder gets full boiler pressure when the slide valve on the disabled high-pressure side is blocked clear ahead. If that were so, I should hate to be firing the way-car stove about the time he got ready to start with 200 pounds of steam in that 34-inch cylinder of his. I believe it is a fact that all these Schenectady engines have pop valves on the steam chest and both cylinder heads of the low-pressure side, and that they are set at about 100 pounds.

The impression was given last month by some of your correspondents, that it would take quite a tankful of oil to get these engines over the road. Perhaps the engines are new, and the record will be improved; for it is certain that some reliable builders of compound locomotives (and other engines) claim a saving over the amount of oil required for simple engines.

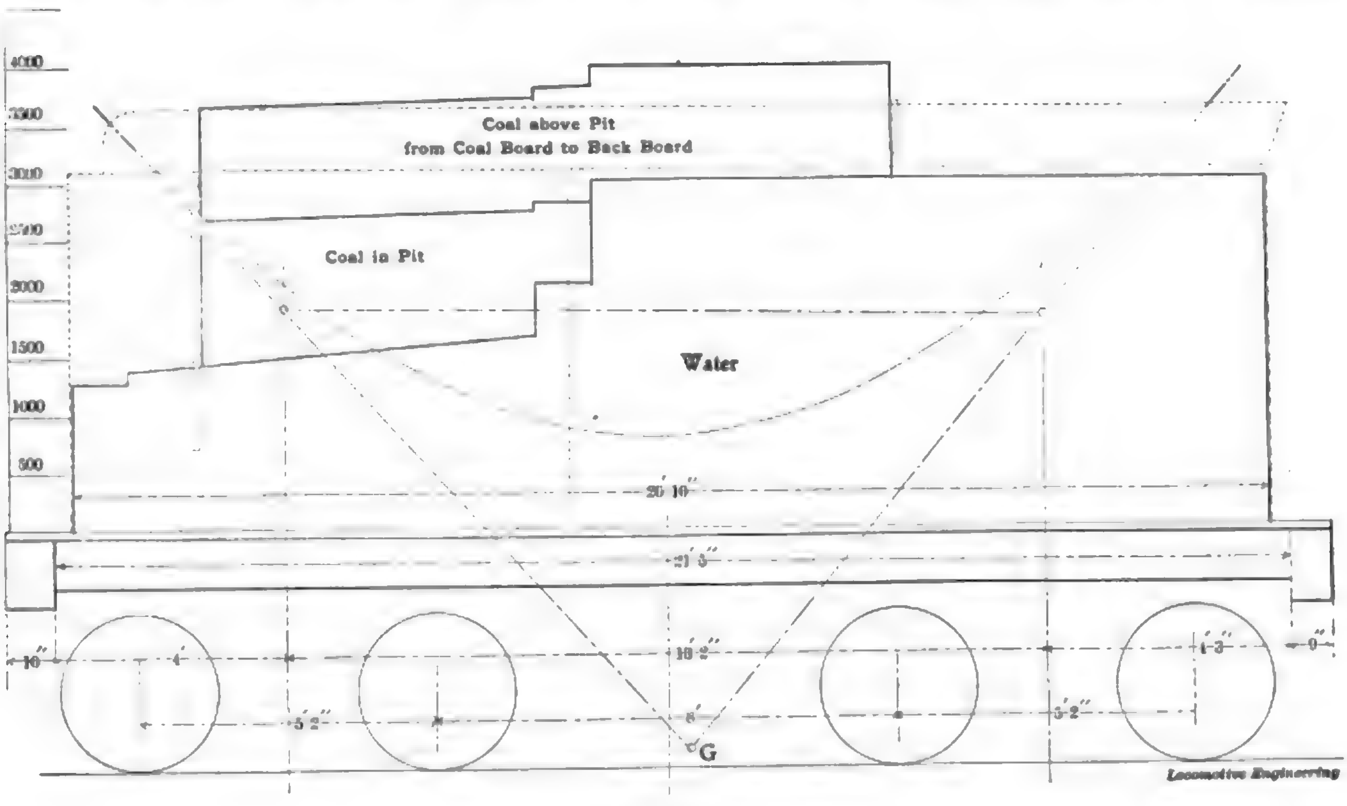
However that may be, the amount of oil used or not used is about as important, compared with the coal pile, as is the question of the amount of ashes left by burning different grades of coal, and I sincerely hope that LOCOMOTIVE ENGINEERING will not fail to publish all the information relative to fuel and water economy that it can get from its many readers. I am sure this can be done without "calling names" where it would be inadvisable to do so; and furthermore, that your source of information—your many readers among engineers and firemen—is so much greater than any committee of any organization can command, that there will be some interesting reading—and to the point. Your readers and correspondents are not the kind that beat about the bush on such matters.

E. W. PRATT.

Chicago, January 20, 1899.

Large Tenders.

The great increase in capacity of modern locomotives has brought problems in its train that affect not only the machinery department which has to handle them and their repairs, but also the civil engineer who has to provide suitable track and bridges to sustain them. As the power developed is increased, so also is the amount of water and coal required; so that with a given spacing of water and coal stations, the very large engines must be provided with tenders of much larger capacity than were formerly needed. Tanks holding 3,000 to 4,000 gallons of water and coal space for 6 to 8 tons of coal will weigh, when fully loaded, from 65,000 to 85,000 pounds, and are generally carried on a total wheel-base of 15 to 16 feet. These are weights which correspond very well with those of fully loaded 40,000 and 60,000-pound capacity cars; but on account of the shorter total wheel-base, the load is much more concentrated.



LARGE TENDERS.

As ordinary ten-wheelers and mogul engines have as great, or greater, weight per foot concentrated in the rigid wheel-base, these tenders have given no trouble on structures capable of carrying the engine.

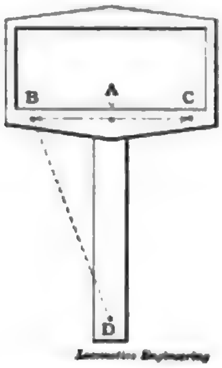
Now suppose that we consider the case of a large capacity engine, having a 6,000-gallon tank and to carry 10 tons of coal. This tender complete, fully loaded, will weigh from 110,000 to 115,000 pounds, nearly 30 per cent. increase in weight per foot over the heavier tank previously mentioned, if carried on the same wheel-base, and equal to the weight on three pairs of

drivers of a very heavy engine. A 6,000-gallon tank may be made 20 feet 11 inches long, 9 feet 6 inches wide and 5 feet 3 inches deep, and a study of such a tank is shown in the accompanying illustration to show the disposition of the load to the trucks.

It is assumed that the tank and tender frame are sufficiently symmetrical to make a uniform loading, and only the weights of the water and coal are considered. The lower inclosed space marked "Water" graphically represents the weight of the water, plotted on a scale of 1,000 pounds per 1 inch in hight. Back of the pit the weight and corresponding hight are uniform per foot; but the tapering water legs and semicircular ends make the front part of this diagram irregular. The weight of the coal in the pit is shown extending from the coal board to the back of the pit.

As coal weighs less per cubic foot than water, the top line of this diagram, which represents the combined weight of the water and coal forward of the pit back sheet, does not come quite up to the weight of the solid water back of the pit. In this case the weight of the coal in the pit amounts to 7,600 pounds, and as 10 tons or 20,000 pounds is to be provided for, the balance of 12,400 pounds is uniformly distributed from the coal board to the back board on the top of the tank and over the pit, and is so shown. From the appearance of the completed diagram it would seem that the loading is quite equally distributed to the trucks, and it is very fair, as can be seen by running in a moment curve, from which is shown that the center of gravity of the load lies over the point *G*. As this point is only 4½ inches from the exact center line between the trucks, there is a slightly greater load on the back truck. If necessary, the trucks can be shifted to meet the point exactly; but as the center of gravity goes forward as the water is used, it is likely that the truck locations as shown, which were selected for structural reasons connected with the frame, will be satisfactory, and that average loading and wear of brasses will be equal all around. C. A. SEELY.

St. Paul, Minn.



FORGING VALVE YOKE.

Forging of Valve Yoke.

Enclosed is a sketch to show how a blacksmith can accurately square up a valve yoke without use of the former. Let *A* be the center of the yoke. With calipers set at *A*, scratch a line clear across the yoke, and with dividers set off the points *B* and *C* equal radius from *A*. Mark these points and then mark *D* on end of stem. Then, using *D* as a radius, measure to the points *B* and *C*. If the distances between *D* and *B* and *D* and *C* are equal, the yoke is bound to be square.

JAMES RAHILLY.

Niles Tool Works, Hamilton, O.

Heating Feed Water.

Having noticed in the various railroad papers at different times accounts concerning the heating of feed water in locomotive tenders, I send you herewith the results of a test made by me about four years ago, covering a period of nineteen days, with an average mileage of 120 miles per day.

The plan pursued was to turn the exhaust from the air pump into the cistern of tender to determine how hot the water could be made and whether it could be made too hot for the injectors to take up.

The arrangement consisted of a simple iron pipe 1½ inches in diameter connected to the exhaust opening of the air pump and carried back to the tender. This pipe entered the cistern on top, near the tank valve handle, and passed down to the bottom, thence along and around to the other leg of water space; ⅛-inch holes were drilled in the pipe, the combined area of same being considerably more than the area of the pipe opening, so that there would be no back pressure on the pump. No provision was made for a drip in the pipe at any point. The condensation, if any, as well as what small amount of oil there may be from the pump was carried into the water in tank, which we think would be beneficial rather than otherwise.

The lowest or initial temperature of the water was 65 degrees, and the highest obtained was 114 degrees, the average for each trip being 89¼ degrees, and at no time did we experience any trouble in working the injectors. On one trip of 52 miles, taking in a little water about half way, the temperature was increased from 65 to 76 degrees; but the average as above given shows an increase of about 24 degrees, which, if we take the general authority on feed-water heating, would show a little over 2 per cent. economy in fuel. This on some roads where coal is high in price would be quite an item, while on others it may be different.

In any event we are inclined to the plan being used, as it not only shows a slight economy in fuel, but also disposes of the question as to where may be the best place to pipe the air pump exhaust.

Before making the above test on the road we tried the plan on an engine standing in the house with the following results:

Temperature of water before exhaust was turned in tank, 68 degrees.

Temperature of water after exhaust was turned in tank 1 hour, 90 degrees.

Temperature of water after exhaust was turned in tank 2 hours, 110 degrees.

Temperature of water after exhaust was turned in tank 2½ hours, 118 degrees.

Injector lifted the water at 118 degrees and delivered it at the boiler check at 160 degrees.

I would further state that this test was made during the months of June and July. J. L. LAWRENCE,
General Foreman.

Chambersburg, Pa.

Exhaust While Drifting.

In replying to Mr. Wallace as to the cause of the supposed exhaust while engine is drifting, here is what the American Balance Valve Company says, as they use no relief valve: When the engine is running rapidly without the use of steam, a partial vacuum is formed in the chest by the air being drawn into one end of cylinder by the receding piston. In the other end of the cylinder on the opposite side of the piston compression takes place. The vacuum tends to relieve the ring of its natural tension, and the valve being held down only by its own weight, it is raised off its seat by the compression at the end of the stroke. The valve is thus floated in the chest while the engine is in rapid motion. This is fully proven by evidence of the top of the disk running against the bearing plate, which it can only do when the valve is ⅛ inch off its seat. The valve therefore being ⅛ inch off its seat, the cylinder has free relief from one end to the other, and relief valves in the chest are not a necessity. We are of the opinion that the supposed exhaust is caused by the compression at each end of stroke blowing through to exhaust when valve is raised. WALTER C. GARAGHTY.

Philadelphia, Pa.

The Joseph Dixon Crucible Company have favored us with their calendar, which is rather small, but neat. A college girl is pausing in her pursuit of knowledge long enough to let an owl with a dunce cap share the joys of a red, red rose—and of course there are several Dixon pencils in the foreground. On the back there are calendars for 1900 and 1901, which are handy when you are building air castles for the Paris Exposition, etc.

One of our correspondents writes: "I am very sorry to know you were burnt out. I can heartily sympathize with you, for although I have never been exactly burnt out, I have often been fired." Next!

Canadian Saddle Tank Engine.

The saddle tank locomotive illustrated on this page was recently built by the Canadian Locomotive Works, Kingston, Ont., for the B. C. Mills Timber & Trading Company, Vancouver, B. C. It is standard gage, and has cylinders 13 x 22 inches and driving wheels 42 inches diameter. The engine in working order weighs 60,000 pounds. The boiler is 46½ inches diameter at the smokebox, and is designed to carry 150 pounds working pressure. The engine is equipped with all modern appliances and conveniences to be found upon the modern full-grown locomotive.

The Santa Fe Instruction and Reading Room.

The Atchison, Topeka & Santa Fé Railway Company has made a new departure in the way of putting up a comfortable and commodious building for the sole benefit of its engineers and firemen, in order that they may improve themselves in their branch of railroad work.

This building is located at Topeka, Kansas, is of frame construction, 24 x 60 feet, and has four rooms, three of which will be at the disposal of employés in engine service. The fourth, and smallest, will be reserved by the company as a store room for engine supplies. The three rooms to be used by the engineers and firemen will be termed "Reading," "Air-Brake Instruction" and "Wash Room."

The building is equipped with steam heat and electric light. The reading room is finished in natural wood, and the walls are white, hard finish. Plenty of windows have been provided, so as to insure good light.

Lockers have been built in on one side of the room, so each engineer and each fireman may have a place to put his belongings, such as his clothes worn on the engine, etc. Those of the engineers are separate from the lockers provided for the firemen, and all are provided with lock and key, and each locker has a number corresponding with the seniority age of the engineer or fireman, as the case may be; the oldest employé of each class on the seniority list taking No. 1, the next oldest No. 2, and so on until the last man is reached. These lockers are a source of great convenience, and are thoroughly appreciated by those who use them. Two long tables, extending almost the full length of the room, are amply provided with reading matter. Here may be found all the latest publications of railway literature, as well as the daily papers, comic weeklies, etc. On the walls are pictures of the various types of the locomotives of the present day.

The wash room, the friend of the enginemen, is just off from the reading room, and has hot and cold water. The washbowls, three in number, are of polished copper, above which is hung a large mirror. Plenty of clean towls, good soap, combs and brushes are furnished, as well as shoe polish, etc.

Now we come to the air-brake instruction room. Here we find every conceivable contrivance for the thorough and complete study of the air brake. All parts are shown separately, so the interior of each may be thoroughly examined and studied. These parts are also shown collectively in operation. Lubricators, injectors and other necessary adjuncts of the locomotive are here shown to advantage, both in operation and out; and experts both in air-brake work and other special lines are provided to instruct and teach the necessity of each part, to explain to those who are working with these parts each day the whys and wherefores, the reason each part performs the duty assigned to it. The enginemen on the Atchison will have no excuse for not knowing their business thoroughly, as it is the intention of the company to give them every opportunity to learn it.

This instruction room is a specially good thing for firemen, for it aids them more and gives them the chance to learn what other men before them have never had. A library of scientific works and those treating on the locomotive from its infancy up to the present day is talked of, and no doubt, if the enginemen show enough interest in this good work which the company is doing for them to justify it, it will be forthcoming. At present this is a sort of experiment which will be left to those for whom it was created, to increase or diminish its growth and usefulness along the lines at the several division points. What a grand thing if this great system could afford to erect at each division point a home for the engine crews

CANADIAN SADDLE TANK LOCOMOTIVE.

of this kind. Other comforts could be gradually added besides those already furnished at Topeka; and with the knowledge gained in study and the reading of the best class of literature, both scientific and otherwise, I believe the interests of the company would receive better attention and would be better protected by its employés. The cost of erecting and equipping such a building as we have here is something like $1,500. The building is painted a dark red.

M. P. Gregory.

Link Templates, Etc.

The sketch shows a form of template, a number of which are in use in the Fall Brook Railway shops, to keep the link bars to the correct radius, and also to facilitate fitting when reducing the lost motion.

As the links on road locomotives wear the most near the mid-gear position, it follows that when they are closed together to take up the wear some guide is necessary to enable one to know how much and where to remove the high places.

Too often this work is done by the cut and try method of filing off the separating blocks at the ends and then putting the link together and filing or grinding the bars until the block will freely slide from one end to the other.

This practice, if followed successively, will result—especially if a link becomes badly cut—in distorting the shape of the bars so that they will conform to a curve of a radius different from that of the original.

This condition has been met in actual practice, and so bad that it was impossible to "square" the valves in all notches of the quadrant.

The gages shown save this, and also save time in getting a thorough job. They are also very convenient for the planer hand in getting the exact curvature on new work.

These were made from spring steel plates, ½ inch thick, annealed sufficiently to be worked, and were not afterwards hardened.

As will be seen, each template is really two in one, for the convex and concave bars.

A combination of small defects in making general repairs like the one mentioned in regard to closing the links, is often the cause of the bad-working locomotives found on many roads to-day.

It may not be out of place to mention that in an article on setting valves, in a recent issue, the practice of lengthening or shortening link hangers to equalize the cut-off on opposite sides was tolerated. This practice, it seems to the writer, should be strongly condemned, and never allowed unless absolutely necessary, and the latter will hardly occur.

Of what good are the hours spent over the drafting board by the designer in locating parts and getting dimensions correct in order that the functions of a valve motion can be properly performed, if these parts are to be changed to overcome some imaginary difficulty?

While it is true, undoubtedly, that there are locomotives with improperly designed valve motions, it is also true in a larger sense that these parts have been butchered in the back shop by careless and slipshod methods of doing work.

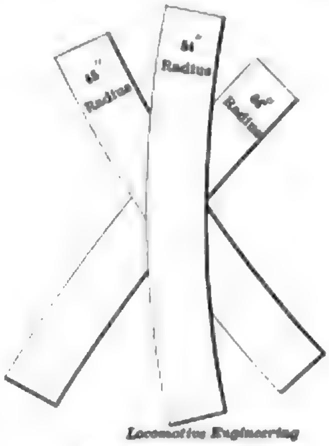
If an engine has ever had an equalized cut-off, it can be again attained by care in general repairs, and at a less total cost than by some of the expedients in use.

Fred E. Rogers.

Corning, N. Y.

Lighting Headlight Under Difficulties.

I see in the January number that some modestly inclined knight of the iron horse has contributed a very good recipe for lighting a headlight on a windy night. I have had considerable experience in that kind of railroad trouble. I have tried many different kinds of schemes, and one



LINK TEMPLATES.

of the best I ever tried was to remove the chimney wick tube casing and button, trim all the burnt crust from the wick, replace the button and casing, then take a small piece of thin manifold paper. An old train order acts very well. I wrap it two or three turns around my finger so as form a kind of hollow tube, slip it down over the button and inside of the wick tube casing so that the lower edge of the paper will come in contact with the wick and the top extend slightly above the button.

Put the chimney on, and the paper soon becomes saturated with oil from the wick. When I wish to light the headlight, I just light a match, hold it in the top of the chimney for a few seconds until it gets a good start, then drop it down the chimney. The burning match ignites the thin, oily paper, and that will burn down to and light the wick, and the job is done. I have often lighted headlights by this plan when all other plans have failed.

Wm. Bosley.

Mattoon, Ill.

To Make Smokeless Firing Work.

I agree with your method of smokeless firing, but smokeless running must accompany it. I know of runners who will take the coal out of a firebox as fast as one man can possibly put it in.

I want to give you a little experience that I had. After reading your report on "Smokeless Firing" on some Western road, I asked my fireman what he thought of the theory. He hadn't seen it; but that night he looked it up, and the next morning he said, "I am going to try Sinclair's smokeless firing."

Now I must give you a description of engine and grade: Cylinders, 19 x 26; firebox, 11 feet 4 inches long, no brick arch; grade, 68 feet to the mile; eighteen loads, 60,000 pounds; distance, five miles. We made three trips up this hill with less black smoke than we generally had in getting the train started. The general rule is: As soon as the engine makes one exhaust, to break up the fire, then the fireman throws in from five to fifteen scoops of coal.

Now, I claim my fireman was working under difficulties, but made a success. He had more steam with one-third less coal. But the fireman must have the assistance of the engineer. When the engineer starts the hind end of the train first and leaves the links dragging on the ties, throttle wide open, one shovel of coal don't stop in the firebox long enough to get warm.

If the operative department would arrange to give engineers regular firemen, who would take an interest in their work and be willing to improve and learn, it would be a great saving to the company.

In some places there is no incentive to be saving of coal, for there is no individual account of coal. The engine is loaded at the chutes; all that will lay on standing still, and when running it will lose off by the ton. I think if the hostler would back the tank on the scales before he goes to the pockets and light weight, then weigh the loaded tank before taking water, and charge every engine with what coal she has, there would be some encouragement for enginemen to economize in using coal. I think there is 90 per cent. more coal wasted by poor firing and running and by losing off along the line than by oil used extravagantly.

The great cry is on oil, but if there were a little more care taken with supply cans, there would be a greater saving in that source. It is a common thing to see oil running out of tank boxes where the supply cans are kept; and the hand cans are filled with cold oil, set on the shelf or boiler, and as soon as it gets warm the oil runs over. If this were saved and put on the bearings, it would save lots of hot boxes. Now, I'm in favor of economy; but when the company will refuse the fireman a 15-cent can, and waste 15 cents' worth of oil through a leaky can, it is poor encouragement to economize.

I started in on "smoke," and have wandered off from the subject entirely—perhaps got lost in the smoke; but I should like to hear from some other engineer on this subject; and if this misses the waste casket, I may have something to say in the future. B. V. Francis.

Galeton, Pa.

Smokeless Firing.

Smokeless firing is the topic for all who are connected with the handling of steam engines, yet we find so many who say it cannot be done. You will find the ambitious and young fireman ready to improve and listen to advice given him, but by the time he has been a year firing he has been with so many different engines and engineers that any old way will do, and when you ask if they have the latest notice in regard to firing, your answer is: "You have no kick coming, as I kept her hot; the coal don't cost you anything." I have been on a run which pulled from three to five cars north, and made from twenty-one to twenty-seven stops, and nine to twelve cars on the return trip.

I have had a good many firemen, and those who fired without smoke were always trying and doing their best, and in that way I was able for years to handle a large train with a small engine, which was worked to the full capacity, and got the name of being the best one on the road, and at different times when engine was in for repairs had one of the others, which we did as well with as our own, and I found that a fireman who was careless in regard to smoke generally burnt nearly a ton more coal, and the time was harder to make on account of engine not working as free and easy, although I was using more oil in cylinders than with regular fireman. Four or five firemen who have been with me are engineers today, and first-class ones, knowing how to get the most work out of their engines, and most all readers of Locomotive Engineering. Railway companies which encourage advancement with ability will find it one of the big steps toward smokeless firing when properly looked after.

Firemen should learn to hold shovel so that with a little turn of the wrist they can turn the shovel as it enters the doors, and they will find that the corner will be reached easily without that big jerk some use, and scatter coal from front back along sides, as some will fall off toward center of fire, and arch protects this part of fire. So very little coal is wanted under arch, but next the flue sheet will want to be fed regularly and often, as this is one of the weak spots of your fire. If let get thin there is a rush of cold air into flues, and your bright even fire in the rest of the box will not overcome this cooling effect, and when you shake your grates you will find partly burnt coal in ashpan; also when you shut off there is a volume of black smoke, showing that your fire was not receiving proper supply of air evenly, and what should have been heat is now passing out as smoke. I have found that to shake the grates when shut off gives you a chance to loosen fire without having all the bright red pulled into flues.

W. H. W. Roberts.

Cincinnati, Ohio.

Richmond Locomotive for Plant System

The ten-wheel locomotive hereby shown is one of a number recently built by the Richmond Locomotive Works for the Plant System. The weight of the engine is 138,000 pounds, 104,000 of that being on the driving wheels.

The cylinders are 19 x 26 inches, and the driving wheels are 69 inches diameter. The boiler is 60 inches diameter, and is built to carry a working pressure of 200 pounds to the square inch. The engine has a little over 23,000 pounds tractive power and a ratio of adhesion of 4.5.

Cast steel has been used to considerable extent in the construction of the engines, the driving wheels and a variety of other parts being of that material. Richardson balanced valves and United States metallic rod packing have been used on the engines. There are very few other specialties. More particulars will be found on our skeleton diagram of the engine on page 116.

TEN-WHEELER FOR PLANT SYSTEM.

The man who develops an old idea into a commercial success deserves more credit than the one who "thought of it," but never worked out the details successfully. He cannot, however, afford to ignore the claims of the originators, as it gives the appearance of claiming more than is due. The successful man can afford to be generous.

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Car Builders' Combination.

Following the example of the leading locomotive builders, a combination has been formed by the car builders for the regulating of prices. The prospectus of the American Car & Foundry Company, which is soon to be incorporated under the laws of New Jersey, was issued last month. The new corporation is to be a consolidation of the following concerns, which are engaged in the manufacture of freight and passenger cars: The Michigan-Peninsular Car Company, of Detroit; the Jackson & Woodin Manufacturing Company, of Berwick, Pa.; the Missouri Car and Foundry Company, of St. Louis; the Ohio Falls Car Manufacturing Company, of Jeffersonville, Ind.; the Union Car Company, of Buffalo; the St. Charles Car Company, of St. Charles, Mo.; the Wells & French Company, of Chicago, and the Terre Haute Car & Manufacturing Company, of Terre Haute, Ind. The total annual capacity of the united companies is 86,500 freight cars, 500 coaches, 820,000 wheels, 125,000 tons castings, 30,000 tons of pipe and 90,000 tons of bar iron.

The capital stock to be authorized is $30,000,000 7 per cent. non-cumulative preferred stock, and $30,000,000 common stock. Of this, $2,400,000 of preferred and a like amount of common stock are to be retained in the treasury of the company for the acquisition of other properties, for improvements, etc.

The locomotive builders have not been particularly successful with their combination, and we believe that the business of car building has elements of disagreement that are not even found among locomotive builders.

When the demand for cars or locomotives is best, there is no difficulty in keeping up prices; but when orders become scarce and every car builder is striving his very best to get ahead of his competitor, prices always suffer more or less, and instead of open competition the combination enables certain parties to underbid the others secretly or to give special advantages to the buyer. The various car builders are getting all they can do now, and they are very stupid if they are doing work for nothing or for less than a good profit to reimburse them for the long idleness when their capital was unremunerative.

We do not believe that a combination will profit the car builders much, and we know that it would arouse the ire of a great many railroad companies. Railroad companies are not backward in combining themselves for the purpose of maintaining rates, but they hate to see a combination among manufacturers who furnish them with supplies.

Scarf Against Butt Welding of Flue Tubes.

Things or operations that seem rationally to be the best methods sometimes turn out in practice to be far from perfect. In all railroad shops it is necessary to weld safe ends on flues that have been removed from boilers, and the principles of common sense say that the best method of welding the ends together would be to scarf the two ends so that they should make a lapping fit, and then heat them to the welding temperature and squeeze them together. That is the ordinarily followed plan, and it does fairly well; but some master mechanics who have tried other methods say that scarf welding is an inferior means of attaching tubes to their safe ends.

One very intelligent shop foreman that we interviewed said that he had tried scarf welding and butt welding, and he found that the scarf-welded tubes invariably pulled apart where they were supposed to be welded, and at a maximum pressure of 22,000 pounds, not one of the scarf-welded tubes was actually welded, although every care was used to make a good job of them, the man who welded them being a man of experience in this line of work. The scarfs invariably pulled apart and showed that they were simply stuck together and not thoroughly welded. The first tubes welded by the butt-weld were treated to the same pulling test and broke through the weld at about 22,000 pounds, showing a clean but hard-brittle fracture. In order to do away with this hardening of the metal at the weld, the following method of making the butt-weld was followed: A long, close-fitting mandril was swung from a post back of the forge, so that the end of it would swing around so as to be just above the fire. A collar was keyed on this mandril at the right distance from the end. The safe-end and tube were placed in the fire and brought to a welding heat, at the same time the mandril was turned so that it would be directly over the fire. In this way, while the safe-end and tube were being brought to a welding heat, the mandril would be heated to a fair red heat. At the proper time the safe-end was slipped on the mandril and against the collar, the tube was then put on the mandril and the end struck several light blows with a light hammer. The weld was then allowed to cool slowly and then tested, when it was found that the hardening of the metal at the weld had been done away with and a weld made that would not break until 35,000 to 40,000 pounds pressure had been applied. The tubes were 1½-inch Algerite, and it took a pressure of 42,000 pounds to pull a new piece in half.

In making the butt-weld great care was taken to have the welding heat uniform, and the mandril on which to weld them hot enough to prevent the weld from becoming chilled and hardened. It was also found that the weld could be spoiled by striking too many blows with too heavy a hammer; four or five blows with a 5-pound hammer being sufficient to make a good weld, and if care be taken in matching the end, no dressing up is necessary.

Iron and Steel Boiler Tubes.

The unusually high steam pressure that has been growing common in locomotive boilers has been putting all the details under very trying ordeals, and we are constantly hearing of failures where comfortable assurance and certainty of safety used to be the rule. We find much tribulation among those who have care of boiler tubes under the new conditions of high pressure and intensified heat. There is a tendency to discredit the knobbled iron tube in favor of seamless drawn soft-steel tubes. There is a movement in favor of better inspection of the charcoal-iron tubes formerly received without question, and especially in the inspection of the welded seams. From conviction we hold by the lap-welded charcoal tubes, and we feel certain that the government naval officials who have specified steel for torpedo boat boilers have made a mistake; yet we are not oblivious of the fact that many welded iron tubes have been put in boilers which deserved going into the scrap heap.

Where a high grade of material and high grade of workmanship have been maintained, we think that the lap-welded iron tube is as much superior to the steel tube for 225 pounds per square inch as it was for 100 pounds per square inch; but carelessness on either side will bring disaster to the party whose material does not pass successfully through the test or-

deal. The ordinary test ordeal does not, however, do justice to the material and character of a flue tube, although that is its means of approval or rejection. Putting in a set of tubes and making them watertight or free from leakage is an operation dependent very much upon the skill of the tube setter. It is only when the tribulations of hard service and the contracting and expansion from variations of temperature show themselves, that the good, reliable tube begins to demonstrate that the commonplace feature of failing to leak is better than the high-tone claim that "this is the most durable tube offered to the department." A peculiarity of steel tubes is that when they once begin to leak and have to be rolled or expanded, the ends never fit the tube-plate holes, and that they always leak on the least provocation until the end of their reduced usefulness. The steel material is more susceptible to changes of temperature than iron tubes, and is therefore more liable to fail under extreme conditions. The naval engineers might have learned useful lessons about boiler tubes if they had given a little more attention to the experience of railroad master mechanics. The latter, as a rule, have refused to purchase steel tubes, because they were found inferior to those made from iron, and their conditions of preventing leakage were just as hard to meet as those of the rapid steam-making torpedo boat.

Energy and Power.

Engineering writers are much given to using the terms energy and power as if the words conveyed the same meaning. We have often wished to demonstrate the difference in the two terms, but the distinctions were difficult to define, and we never perceived them clearly until we saw them defined by Professor Reynolds, who says:

"Although the terms energy and power are in continual use, such use is seldom in strict accordance with their scientific meaning. In many ways the conception of energy has been rendered popular, but a clear idea of the relation of energy to power is difficult. This arises from the extreme generality of the terms; in any particular case the distinction is easy. It is easiest to express this distinction by an analogy; but as a matter of fact, everything that seems analogous is really an instance of energy. Power may be considered to be directed energy; and we may liken many forms of energy to an excited mob, while the directed forms are likened to a disciplined army.

"Energy in the form of heat is in the mob form; while energy in the form of a bent spring, or a raised weight, matter moving in one direction, or of electricity, is in the army form. In the one case we can bring the whole effect to bear in any direction, while in the other case we can only bring a certain portion to bear, depending on its concentration. Out of energy in the mob form we may extract a certain portion, depending on its intensity and surrounding circumstances, and it is only this portion which is available for mechanical operations.

"Now energy in what we may call its natural sources has both these forms. All heat is in the mob form, hence all the energy of chemical separation, which can only be developed by combustion, is in the mob form, and this includes the energy stored in the medium of coal. The combustion of one pound of coal yields from ten to twelve million foot-pounds of energy in the mob form of heat; under no circumstances existing at present can all this be directed, nor have we a right, as is often done, to call this the power of coal. What the exact possible power is we do not know, but probably about four-fifths of this, that is to say, from eight to ten million foot-pounds of energy per pound of coal is the extreme limit it can yield under the present conditions of temperature at the earth's surface. But before this energy becomes power, it must be directed. This direction is at present performed by the steam engine, which is the best instrument art has yet devised, but the efficiency of which is limited by the fact that before the very intense mob energy of the fire is at all directed, it has to be allowed to pass into the less intense mob energy of hot water or steam. The relative intensity of these energies are something like twenty-five to nine. The very first operation of the steam engine is to diminish the directable portion of the energy of the pound of coal from nine millions to three millions. In addition to this there are necessary wastes of directable energy, and a considerable expenditure of already directed energy in the necessary mechanical operations. The result is that, as the limit, in the very highest class engines the pound of coal yields about one and a half millions of foot-pounds; in what are called "first-class engines," such as the compound engines on steamboats, the pound of coal yields one million, and in the majority of engines, about five or six hundred thousand foot-pounds. These quantities have been largely increased during the last few years; as far as science can predict they are open to a further increase. In the steam engine art is limited to its three million foot-pounds per pound of coal; but gas engines have already made a new departure, and there seems no reason why art should stop short of a large portion of the nine millions."

Expanding Nozzles.

Within the month we have received two letters asking for information about the value of expanding exhaust nozzles and to what extent they have been used on locomotives. We do not think of any one of the numerous attachments or reputed improvements that have been put upon the locomotive about which there are so many conflicting opinions or policies as there have been regarding expanding nozzles. In our protracted experience with railroads we do not remember a year when there was not at least one new expanding nozzle under trial, and sometimes there were five or six brand new ones, each being zealously commended by its friends.

The history of the expanding nozzle is almost as old as the history of the locomotive. Timothy Hackworth, who was superintendent of the Stephenson Locomotive Building Works and taught the Stephensons, father and son, the principal things about the locomotive that they got credit for inventing, was the first man to properly understand the value of exhaust steam passed through a nozzle central with the smoke-stack as a generator of draft in the firebox. He carried the practice of contracting the nozzle too far, and his engines suffered from back pressure in the cylinders. Nevertheless, many early designers imitated Hackworth's practices, for they had the merit of making the engines burn freely the hard coke which was for two or three decades the only fuel permissible for locomotives to burn.

During the first twenty years after the opening of the Liverpool & Manchester, the first railway in England built to carry passengers, the companies were permitted to charge about the same fare as stage-coach companies were accustomed to exact from passengers. That was exceedingly high, and it was a very profitable thing for railway companies under its tariff. People, however, soon realized that it cost much less to move a passenger on a railway than it did to carry one on a stage coach, and rates for railway travel were gradually greatly reduced by acts of Parliament. Before that there was so much profit in railroad operating that the word "economy" was forgotten. When reduction of rates and competition began to have their natural results, railway managers realized the necessity to close up leaks, and, as usual, the first attention was bestowed upon the power department. The demand then arose to reduce the fuel bills, which were conspicuous for the prominence they held in operating expenses.

In early railway days there was a locomotive-building concern, Hathorn & Co., of Newcastle, England, that made strenuous efforts to keep in the front in the construction of the best engines for economical and efficient service. That company about 1840 brought out an expanding nozzle which they guaranteed to save a great deal of fuel, since by its use the exhaust could be softened at the times when the exhaust steam put its greatest strain upon the fire. About the same time Richard Norris, who was one of America's earliest locomotive builders, put an ex-

panding nozzle into use, which resembled so closely that employed by the Hathorn people that a dispute between the two ensued, which, however, came to nothing, unless it was to advertise the advantage of employing expanding nozzles.

Since that time, the popularity of the expanding nozzle has fluctuated like a profile showing the ups, downs and levels of an undulating railroad track. The number invented have been legion. We cannot understand why any motive power man who has given the subject of draft appliances any attention or study can fail to acknowledge that an expanding nozzle possesses great fuel-saving capabilities; yet with all the stimulation put upon motive power officials to reduce the expense of their fuel bills, the expanding nozzle has seldom received the support that kept it in use for any length of time. A few railroad companies are using expanding nozzles and the officials report that a very gratifying saving of fuel results; but others do not display any desire to participate in the saving effected from a device which costs next to nothing to apply. We suppose that were hundreds of dollars required to apply an expanding nozzle to each locomotive that the practice would become popular.

The principal difficulty that has spoiled the usefulness of expanding nozzles has been the gumming of the movable connections which made them inoperative when not worked regularly. Devices that would have saved hundreds of dollars monthly for each locomotive have been abandoned because they were neglected. The carelessness implied is, of course, the worst kind of reflection on those in charge; but most of these people seem to stand with impunity implied carelessness that would ruin the reputation of most men pretending to superintend ordinary lines of business.

For years the weakness of the expanding exhaust nozzle was said to be its need of constant attention. The lever operating it was always placed convenient for the engineer who was not half as much interested in its working as the fireman. An intelligent fireman would soon realize that his work of coal shoveling would be considerably reduced in starting from stations and on steep grades if he could ease with the nozzle opening to suit the condition of steam making. He was the man to tell when a little closing or a little opening would be of advantage. Yet we never knew of the lever of the expanding nozzle being placed where the fireman could work it conveniently.

In one or two expansion nozzles that we know of the operation is automatic and is connected with the reverse lever. That has its good and bad points, but on the whole we think it is the best arrangement that can be made.

The principal purpose of an expanding nozzle is to save coal, but it has another purpose when properly used, and that is preventing noise. On many roads where small nozzles are the rule engines starting out of a covered station pain the passengers with the deafening noise of the exhaust steam. In the terminus of the Delaware, Lackawanna & Western, at Hoboken, N. J., an anthracite burning road, we frequently see men and women walking with their hands on their ears to deaden the cannon-like snaps of exhaust steam from engines backing out trains. Other roads are no better, and the easiest remedy is an exhaust nozzle that can be opened sufficiently to permit the steam to escape without intense noise.

Assault on the M. C. B. Coupler.

About the time we went to press with last month's paper, we received, like all other railroad papers, through Mr. A. E. Welby, general superintendent of the Rio Grande Western, a letter written by Mr. John Hickey, the company's superintendent of motive power, in which he expressed intense dissatisfaction with the Master Car Builder type of car coupler. Mr. Hickey has always been noted for having very positive convictions on all prominent railroad mechanical questions, and his views on the shortcomings of the M. C. B. coupler are as emphatic as any of his previous utterances. He says that although this type of coupler has had powerful support behind it from railroad companies, the press and legislatures, it has proved the most expensive to maintain and apply, uncertain as to security of coupling and disappointing as a means of safety. Locking devices that are defective and contour lines that do not conform to each other formed the principal themes of a long letter. Apart from its mechanical weaknesses, Mr. Hickey asserts that the vertical plane coupler increases the resistance of trains on curves, that it has no merit as an automatic coupler, or as a means of holding cars together, and sums up its demerits by saying that the coupler is a failure, that a substitute must be found for it, and the sooner the better.

The views expressed by Mr. Hickey represent the opinions of a small minority of railroad officials who see no prominent points about the coupler except its shortcomings. There has been considerable trouble, expense and annoyance from failures of the vertical plane coupler, but no device could be invented to stand the rough service endured by a car coupler without giving cause for complaint. What causes more trouble than anything else with the M. C. B. coupler is diversity of contour lines, and the railroad companies have themselves to blame for the magnitude of this evil. There are standard contour lines, and the Pratt & Whitney Company went to great expense making gages that would indicate how near any coupler was to the standard; but comparatively few railroad companies took sufficient interest in car couplers to purchase the test gage. Master car builders raised their voices in association and club meetings in favor of rigid inspection of contour lines, and then went home and accepted couplers purchased without paying the least attention to the contour lines. So long as the couplers looked about right they were applied to the cars. Molders who are making car couplers by piece work are not liable to trouble themselves about maintaining exact contour lines; his slipshod production passes along to the car and nothing is found wrong until the coupler fails to match with some other coupler, and causes a break-in-two. The miserably loose methods that brought forth an individual M. C. B. standard axle-box bearing for nearly every railroad in the country, which was not interchangeable with those of other roads, are at work to make the M. C. B. standard coupler a failure. Those who wish to prevent that consummation ought to start out to do battle with the test gage as their main weapon. Let them arm their inspectors at interchange points with that instrument and reject every car that has couplers whose contour lines do not come within the limit of deviation, and the divergence of contour lines will soon cease, also the annoyances resulting therefrom.

It is madness to hold that at this date the M. C. B. coupler is a failure and something else must be found to take its place. There are too many of that type in service. An agriculturist was once assailed by a furious bull and to avoid getting gored he caught the animal by the horns and held on. And he was compelled to hold on until the animal was subdued. To railroad companies the car coupler is a rampant bull. They have taken the vertical plane by the horns, and woe to those who let go until it is subdued.

The assertion that the M. C. B. coupler is expensive to maintain does not appear to be supported by facts. Makers of M. C. B. couplers are nearly all willing to guarantee the maintenance of their couplers for sums that range from 50 cents to $1 a year. No one accustomed to the link and pin coupler would engage to keep up a supply of links and pins for a dollar a year per car. So far as first cost of the coupler is concerned, it counts for little, the cost of maintenance being the principal consideration.

The statistics showing the breaking in two of trains and the kind of coupler that was responsible for each accident are not so full as might be desired, but the information on that line available does not tend to show that the M. C. B. coupler compares unfavorably with the link and pin. Mr. J. W. Thomas, general manager of the Nashville, Chattanooga & St. Louis,

requires particulars of all breaks-in-two of trains to be reported, and the growing data appear to prove that the sooner the link and pin coupler disappears the better will be the prospects for reaching the minimum of coupler accidents.

Capacity of Sellers Injector in Using Hot Water.

In the issue of your journal of February, 1899, replying to question No. 23. "How hot would you dare heat the water in the tank for Sellers 1876 self-adjusting injectors, which are set about 15 inches above the tank; injectors in good order?" you state that "the Sellers 1876 injector will not handle water under these conditions much above 100 degrees." The pressure of the steam is not given either in the question or the reply.

We would call your attention to a test of our self-adjusting injector of 1876 made by the Park Benjamin Scientific Expert Office and published in Appleton's "Cyclopædia of Applied Mechanics," Vol. 1, page 165 (edition 1880). This test showed that the limiting temperature of the supply water is from 121 to 134 degrees, at steam pressures from 10 to 150 pounds, when lifting the supply 15 inches. These tests have been reprinted by permission in a little pamphlet issued by us, and not only correspond with our own experiments, but are confirmed by the injector in actual service. We take pleasure in forwarding a copy of the catalog of our 1876 injector, which contains these tests, and ask that you publish this statement.

WM. SELLERS & CO. (INC.).

[The pamphlet referred to contains a great deal of interesting information, and we recommend people interested in injectors to send for it.—Ed.]

The Carelessness of Private Car Line Owners.

Railroad companies, as represented by the Master Car Builders' Association, have always been very liberal in their treatment of private companies operating lines of cars, but their kindness has been very often scandalously abused. Several private-car line concerns habitually impose on railroad companies, and while securing profitable revenues for their cars, use all sorts of underhand means to have railroad companies maintain their cars without compensation, or let them fall into such bad condition as to be dangerous in train operating.

A good illustration of how owners of private cars impose upon railroad companies and upon the public is seen in a report made to the general manager of the Nashville, Chattanooga & St. Louis. That company follows the sensible policy of making systematic reports of defective air brakes. During the month of January 4,888 cars having air brakes were sent out from the yards at Nashville, and of these thirty-six were cut out on account of the brakes being in bad order. Of that number ten belonged to railroad companies and twenty-six to private-car lines. Most of the defects were in the triple valves, and indicated that gross carelessness was the cause. It is nigh time that something was done to bring private-car-line owners to a realizing sense of their obligations to safe train operating and to the public at large.

A Rejuvenated Ventilating and Car Heating Scheme.

There has been more useless labor expended upon the ventilation of cars than on anything we know of relating to railroad rolling stock, except perhaps that of car couplers. Some inventor seems to have got after the State authorities of Indiana to convince them of the possibility of ventilating and heating cars in a peculiar fashion.

They have recommended that between the windows and walls of the car there be placed ducts leading from the register, level with the floor, out through the top of the car, and that movable hoods be provided to the projecting duct, or else that the ducts be led into a pipe traversing the whole length of the car; such pipes to have valves at each end; the front valve to be closed always, and into these ventilating ducts a branch is to be led from the heating pipes. This arangement, it is said, will warm the air in the ducts, causing it to rise and draw out the bad air from near the floor, at the same time drawing down the warm air from the ceiling, and as such a method draws the bad air out, fresh air may be admitted through a few of the ventilating ducts which are not provided with hot pipes and which contain loose cotton that will strain out dust completely and smoke practically. Further, double doors should be provided, even in vestibuled cars—the second or innermost door to be supplied with closing spring hinges, to contain a glass panel, swing both ways, and stop the narrow passage between the closets and washrooms, which are at both ends.

It seems to us that the arrangement recommended has been tried before, and that it did not work as its friends expected it would do.

BOOK NOTICES.

"Kinne's Improved Enginemen's Guide, Time and Pocket Book." By George R. Kinne, Hornellsville, N. Y.

This is a small book with lap cover, and contains forty-three pages of instruction for enginemen on the subjects relating to engine failures, air brakes, etc., most likely to be a help to readers. The greater part of the information is given in the form of questions and answers. They cover the field fairly well. A table of wages is given which will be found useful by any wage-worker in computing the money due. The remainder of the pages are blank for note-taking. The book is sold for one dollar a copy, and is well worth the price.

"The Speed Lathe," by Alfred G. Compton and James H. DeGroodt. John Wiley & Sons, New York, publishers. $1.50.

This is really the first part of a three-volume work on advanced metal work, and is especially designed for the use of manual training schools. It is, however, of great value to any apprentice, and its one hundred illustrations make clear the different operations to be pursued.

This treats of wood and metal work on the speed lathe, and also has a chapter on metal spinning and burnishing. As very little is known about this in most shops it will interest almost any mechanic. Among the special tools shown is one of the latest designs of forming tool for brass, showing that the authors are abreast of the times. The only cause for criticism are the cuts, and while most of these are clear, the compound rest on page 123 is not at all pleasing to a mechanic.

"The Locomotive Up to Date," by Chas. McShane. Price $2.50. Griffin & Winters, Chicago, Ill.

This is a book which may be regarded as a fair dish of hash on the locomotive. It is like a great many other books that have been written on the same subject, compiled by a man who has no particular knowledge of what he wants to make a book about, but takes from the writings of others things he considers will give sufficient interest to the book to make it sell. There have been too many books of this kind pushed upon the too confiding railroad public, among which we might mention Roper's, Edwards', Grimshaw's, and now McShane's. All these books are by mere book-makers who knew nothing about the subject they were supposed to provide information upon. This book by McShane is particularly ambitious in its scope, covering 711 pages, 5 x 8 inches. A very considerable part of the book has been taken from the pages of LOCOMOTIVE ENGINEERING, some of it with credit, but the greater part without. We notice that Ira A. Moore's articles on shop practices are reproduced without credit, and a great many others. There is a great deal of useful information in the book, but it is very badly digested, and is teeming with errors in texts, type and regarding facts. It is fairly well illustrated with line cuts and halftone engravings, and is printed on good paper. The good quality of paper and the printing is the best we can say about the book.

"Economy is a good thing if it doesn't cost too much to secure it," is a maxim which may well be applied when considering tools in which economy in first cost or power consumed plays an insignificant part.

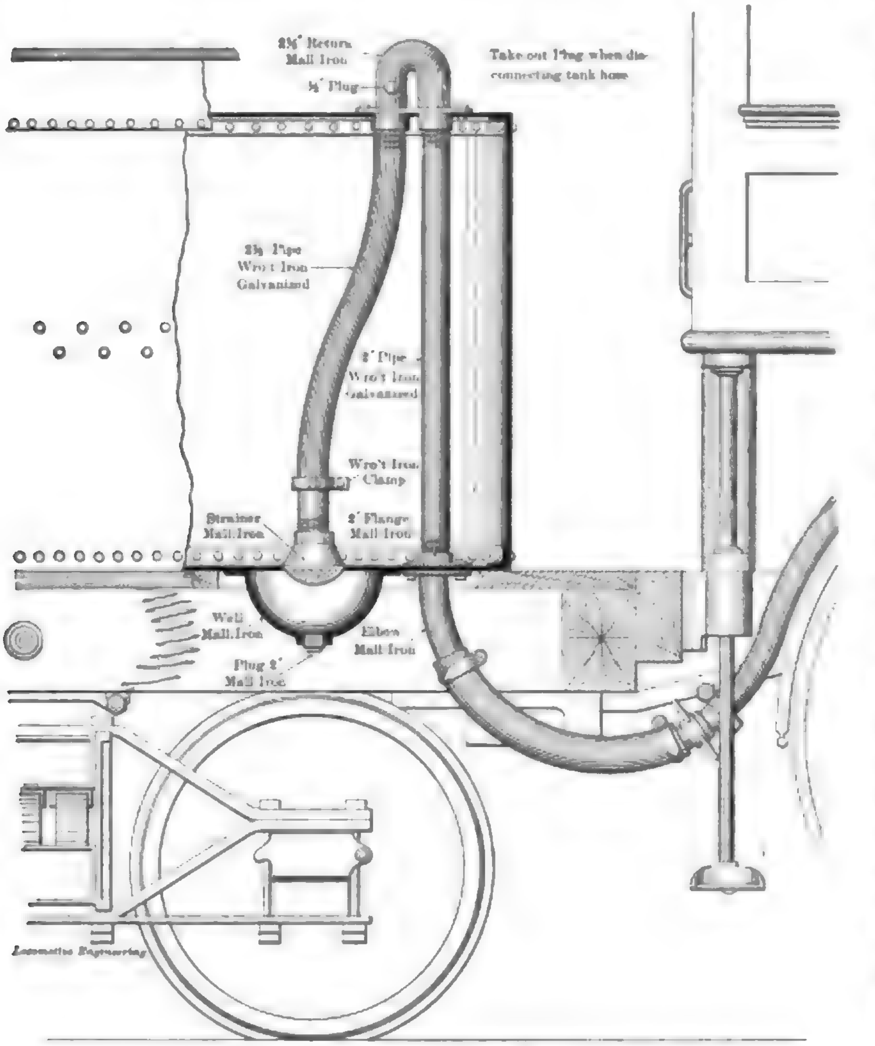
Improved Feed-Pipe Connections.

BY A. M. STEWART.

In looking back over a rather lengthy railroad career in locomotive service, I often contrast in my mind "the good old days" with the present and the wonderful improvement of the locomotive of to-day over those on which I first tried my 'prentice hand as fireman.

They were called "Yarrow" engines, so named after their designer, and were built, I think, in Arbroath, Scotland; and those most prejudiced in their favor could hardly contend that they were specially designed for the convenience and comfort of those who were unfortunate enough to have to earn a living on them. In place of a cab, there was a plate of iron, called a weather-board, which extended partly across the top of the boiler-head, and this was the only protection we had from the inclemency of the weather. There was no injector in those days, and in place of a lubricator we had to go ahead, every time steam was shut off, and oil the cylinders through a cup in front. We did not have dry sand even, and many a time I have sat on the front of the engine, while climbing a grade, feeding wet sand by hand out of a box placed there for the purpose, very often in a blinding storm of snow or rain, while the engineer amused himself trying to keep her hot, and it generally happened that he was the warmest of the two when you came back to relieve him.

Happily, since that time one device after another has been introduced, until there has been evolved the splendid machine of to-day. But while so radical a change has been made for the better, there is still room for improvement, and this has been forcibly impressed on my mind by reading an article in the current issue of the "Brotherhood of Locomotive Engineers Journal," in which the writer describes a method of blowing a tank valve out of its seat, should it become disconnected while shut. Now, I venture to say that there are very few engineers who have not had lots of trouble with their tank valves and hose connections, by the former getting disconnected or clogging up with dirt, and the latter freezing up in cold weather; and it certainly is a very unpleasant experience, if you happen to be climbing a grade with a poor-steaming engine, and you have been swapping water for steam trying to get over the top, with the intention of starting the injectors in time to keep everything safe, and you find that your water supply is defective, and either will not supply the boiler or the injector refuses to work at all. Of course, if by blowing steam back into the tank you cannot remove the obstruction, you must stop and take down your tank hose, and then ten to one you find that your tank valve will not shut off, and before you get the strainer back and the hose coupled up again, you are as wet as a half-drowned rat, while the temperature may be away down below zero.



IMPROVED FEED-PIPE CONNECTION.

In cold weather the hose connections between engine and tank are very apt to freeze, and we know that in some sections of the country this is a frequent source of annoyance. I herewith enclose a drawing of a device patented by Mr. Chas. Linstrom, M. M., Y. & M. V. R. R., Vicksburg, Miss., which effectually cures the evils complained of. By examining the drawing you can readily see the advantages of this device over the old tank valve arrangement, for as the flow of water is started by the vacuum which is created when the injector is primed, the supply is maintained by atmospheric pressure alone, and is not affected by the weight of the water in tank; and as the end of the syphon pipe is in a well at a lower level than the bottom of the tank, the injectors will work until the tank is empty, which in itself is a great advantage, especially where it is desirable to run long distances without stopping for water.

Whatever dirt accumulates in the tank finds its way into the well, from which it can be easily removed by taking out the large plug located in the bottom of the well for that purpose. In frosty weather all that is necessary to prevent the hose and connections from freezing up is to blow steam back into the tank for a moment to empty the hose, which then remains empty until the injector is again started. When the hose is uncoupled, all that is needed to prevent the water from syphoning out is to remove a small plug at top of the suction pipe, thus admitting air, which destroys the vacuum.

I have run an engine fitted with this device for the past four months, and have never had the slightest trouble with my injectors; and with a view to writing this article, I made a test my last trip to see how the injectors would work with the water very low in the tank, and after running a 3,000-gallon tank forty-nine miles with a full freight train, over a rolling section of our division, I brought the engine into the roundhouse pit with the injectors still working away merrily; and on examination I found the back of the tank dry, although, owing to a slight depression in the front of tank, there was still a small quantity there. My experience is identical with that of others who have tried the device, and there is no question in my mind that it is only a matter of time before this contrivance will be universally adopted.

Vicksburg, Miss.

Delaware, Lackawanna & Western Anthracite-Burning Eight-Wheeler.

The eight-wheel, wide firebox engine shown was recently built by the Dickson Locomotive Works for the Eastern division of the Delaware, Lackawanna & Western Railroad, to be used on passenger service. This company hauls an immense suburban passenger train service out of Hoboken. About seven miles out a grade of about 78 feet to the mile has to be climbed for about three miles. Helping engines are employed to assist most of the trains up the hill. The engine shown was designed to pull a train of eight cars up that grade without assistance. The weight of the engine is 124,000 pounds of which 85,700 pounds are on the drivers. The cylinders are 20 x 26 inches and the driving wheels 65 inches diameter. The boiler carries a steam pressure of 180 pounds per square inch. Figuring on these particulars we find that the tractive power of the engine is over 24,000 pounds, the ratio of adhesion to tractive power being 3.5. The engines ought to haul the trains required with ease.

Annexed are the leading particulars of the engine:

Weight on driving wheels—85,700 pounds.
Weight on truck wheels—38,300 pounds.
Total weight of engine—124,000 pounds.
Driving wheel base—8 feet 6 inches.
Total wheel base—22 feet 11 inches.
Wheel base, engine and tender—48 feet 7½ inches.

Cylinders:
Diameter—20 inches.
Piston stroke—26 inches.
Main rod length, center to center—87½ inches.
Valve—Allen-Richardson balanced.

Boiler:
Type—Straight top, wide firebox.
Diameter of barrel, inside, smallest ring—60 inches.
Steam pressure—180 pounds.
Firebox length—10 feet.
Firebox width—96 inches.
Number of tubes—254.
Length of tubes—12 feet 6 inches.
Diameter of tubes—2 inches.
Heating surface, firebox—161.6.
Heating surface, tubes—1662.4.
Heating surface, total—1824.0.
Grate area—80 feet.
Material in barrel of boiler—Central steel.
Thickness of material in barrel—9-16 and ⅝.
Thickness of material in crown—⅜.
Thickness of material in sides and back—⅜.
Thickness of material in tube sheet—½.
Crown stayed with radial stays.
Boiler covering—Asbestos.

Driving Wheels and Journals:
Driving wheels, number—4.
Driving wheels, diameter—65¾ inches.
Driving wheels, diameter centers—57¾ inches.
Driving wheels, material, centers—Cast iron.
Driving wheels, journals—8½ inches diameter, 10½ inches long.
Truck wheel, engine, diameter—30 inches.
Truck wheel, engine, kind—Boies No. 2.
Truck wheel, journals—6 inches diameter by 16¾ inches long.

Engineer Punished for Boiler Explosion

A jury in Detroit, Mich., last month, after listening to the evidence in a trial lasting over six weeks, which was conducted on both sides by skillful attorneys aided by experts, found that the engineer who was in charge of the boilers in the "Journal" building when they exploded on November 6, 1895—over three years ago—was criminally negligent for leaving his boilers for nearly half an hour, and permitting them to explode from over pressure. Thirty-eight persons were killed and a large number wounded.

This verdict is somewhat unusual, as it generally turns out that there are some extenuating or mysterious circumstances, which will clear the responsible parties of any direct blame. This verdict means that the crime of manslaughter is proved; and sentence has been passed against the engineer of a term of years in prison.

The lesson of this verdict will be that boilers must receive proper care continuously; looking around once in a while to see that the water level and steam pressure are correct and safe will not suffice.

These boilers were fired with fuel oil.

Anent the above; in the case of a recent boiler explosion at the hospital connected with the Reformatory at Ionia, Mich., an expert testified that he could tell the exact hight of the water in the boiler at the moment of the explosion, stating from his examination of the boiler some days after the explosion, that there was about 8½ inches above the crown sheet and flues at the time it blew up. When asked by what process he arrived at this conclusion, he said that it was a professional secret.

Now the question comes up, Is such a statement credible? Its effect on the jury at that case was to discredit the evidence of the expert. That was quite proper, too, for the would-be expert was a humbug and a liar.

DELAWARE, LACKAWANNA & WESTERN CULM BURNER.

Does Pooling Locomotives Pay?

In the General Correspondence Department of this issue there is a letter on "The Pool System and Railroad Economy," written by a general foreman of one of our trunk lines. He has extended experience as a mechanical official on railroads that practice the pool system and others that provide engines for each set of enginemen. With that experience he takes very decided grounds against the pooling system as being financially injurious to railroad companies. Instead of saving money for the owners of the reduced number of locomotives doing the work, the system is wasteful and expensive. The subject has never been impartially discussed by those who understand its merits and shortcomings. Railroad companies are certainly interested in seeing this done, and we will gladly give the use of our columns for the discussion of the subject. We shall gladly publish the views of both sides.

Convenient Shop Tools.

The annexed engravings represent tools which we saw in use in the shops of the Chicago, Burlington & Quincy at West Burlington, Ia., and were got out by General Foreman Kastlin.

Fig. 1 is a transportable jack, used for the purpose of placing M. C. B. draw-

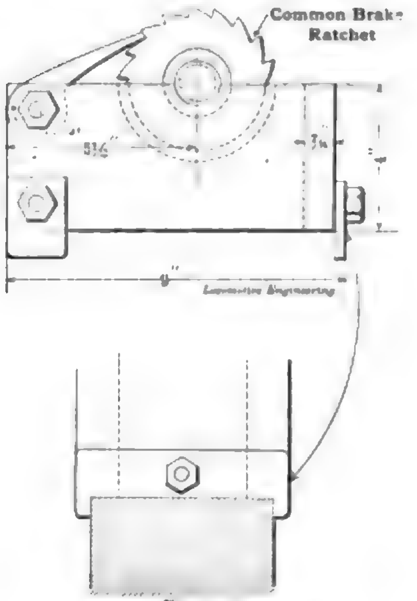


FIG. 2. DRIVING-BOX HOIST.

bars in position. The bar is laid on the carrier provided on the truck, pushed under the cars, and by means of the jack, located in the center of truck, lifted into its proper position. The advantage of this contrivance is that one man can place a draw-bar in its position without taking any chances of accident, because the jack will hold the bar firmly in its place until the carrier straps are placed in position.

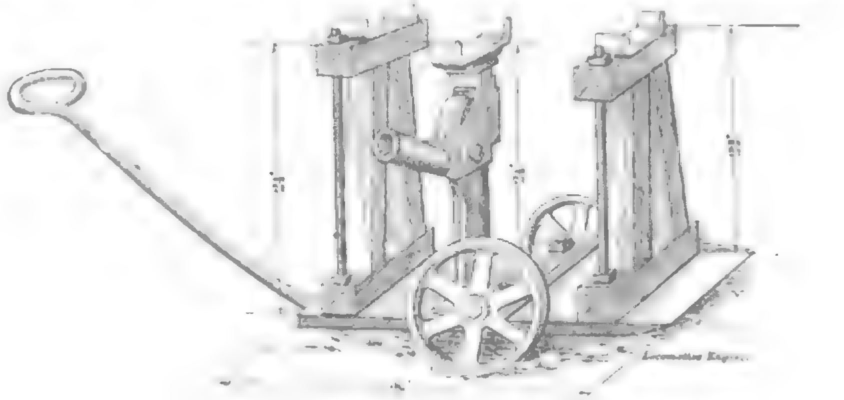


FIG. 1. TRANSPORTING JACK FOR DRAW-BARS.

Figs. 2 and 3 show a contrivance for hoisting driving boxes in proper position. The part shown in Fig. 2 is set on top of the frame, and when the shaft, provided with a common brake ratchet is in position, a chain is attached to the box, and by means of turning the shaft is hoisted into position. Same as in the former case, one man can perform this operation; and if for any cause the box cannot be lifted to where it belongs, the workman can with perfect safety investigate the cause by simply allowing the ratchet to rest against the stop or dog. If it is necessary to let the box down, can do so, make proper adjustment, and again place box in position.

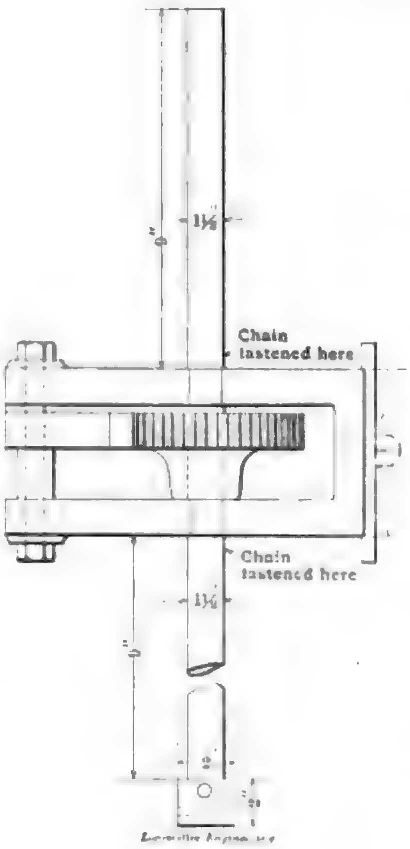


FIG. 3.

Annealing Cast Iron.

In a recent chat with Mr. A. E. Outerbridge, the well-known chemist of William Sellers & Co., we mentioned his discovery of a few years ago with regard to annealing cast iron by rumbling instead of by heating it. This, he said, was called to his attention by noticing that when an old pulley, which had been run for some time, was being broken up, the arms would simply crack and not fly apart. New pulleys, however, on being broken would spring apart at the crack, or even a piece fly out of them.

This is caused by the internal or molecular strain due to irregular cooling, the thin rim cooling much more quickly than the spokes and hub. In old pulleys this strain has been relieved by the constant running of the belt over it, and the many slight jars from the shafting itself. This led him to rumble test bars and to note the increase of strength due this method of annealing, as that is really what it is.

The mention of the annealing of car wheels after being cast in the chill, led to his expressing the belief that if locomotive drivers were annealed in the same way, the trouble with strains resulting from the unequal cooling of counter-weights and spokes would be avoided and the necessity for expansion slots in the rim would disappear. This would remove one annoyance and make a wheel that would be stronger than without the annealing. While large annealing pits would have to be erected, this would not be such an expense for builders as might appear at first sight, and ought to give good results.

It is also interesting to note in this connection the experience of the late Mr. Wilson Eddy with his engines. These had a flat rim, and after wearing a tire down thin he found that the wheel center had grown larger, so that for the same "shrink" the new tire had to be bored a little larger than the old. We do not know that this has been the experience of others, and it probably has little bearing on practical railroading, but to the metallurgist and the mechanical engineer it is of interest and value.

Leaky Steam Pipe Joints.

One of the troubles that is chronic in some engines is leaky steam pipe joints in the smoke arch. In some cases these joints are worked loose by the twist given the cylinder saddle when the engine is pulling hard, or it may be done by the expansion of these pipes, caused by the heat passing through the smoke arch when the flue sheet is comparatively cool. As movement at these joints cannot be prevented a leak soon develops, which interferes with the draft and prevents the engine steaming.

Master Mechanic Hotswell, of the Flint & Pere Marquette Railroad, has cured this trouble in a great measure by making a double joint at each end of the pipe. Instead of one brass ring at these joints, he puts in two with their flat faces together and the convex sides fitting into the pipes. This he finds allows a better joint to be made, and allows for some lateral motion.

The Lake Shore & Michigan Southern stiffen up the extension front with a piece of boiler plate across the bottom and up

the sides, which laps over the end of the first ring in the boiler shell. This makes a very solid job, keeping the cylinder saddle and boiler in line.

Locomotive Foreman Bleasdale, of the Detroit, Grand Haven & Milwaukee, looks after this matter closely. If he suspects that the joints are leaking, the relief valve is unscrewed from the front of steam chest and a pipe screwed in, to which a washout hose is attached. By this means a cold water pressure can be put on the joints and a leak detected at once with a very moderate pressure. This is a big improvement over going in a hot smoke arch with a torch and trying to locate leaks. You can get in and examine every joint.

Florida Central and Peninsular Passenger Engine.

The annexed engraving shows what seems to be a peculiarly designed eight-wheel engine recently built for the Florida Central & Peninsular Railroad by the Cooke Locomotive Works, Paterson, N. J. The engine has cylinders 18 x 28 inches, driving wheels 69 inches diameter, and weighs 111,000 pounds, 75,000 of which rests on the driving wheels. The boiler pressure is 200 pounds to the square inch. Figuring on the proportions and pressure given shows us that the tractive force is about 22,000 pounds, and the ratio of adhesion 3.3, which is very low. What strikes one most about the dimensions of the engine is the length of stroke to cylinder diameter.

On looking over the specifications of the engine we felt curious to know how it acted in service, and we wrote to Mr. T. A. Phillips, assistant general manager of the Florida Central & Peninsular Railroad, who wrote in reply as follows:

"About four years ago we commenced decreasing the size of cylinders in our locomotives and increasing the stroke, and results attained have been far beyond our expectations.

"Our standard passenger engines were 19 x 24 inches, and we had the same general type of engines built by the same makers, giving them 18 x 20-inch cylinders, and we found we could pull more cars and make better time with less fuel and water than with the 19 x 24-inch.

"The last two engines we had built by Cooke; had them 18 x 28 inches, and so far they have showed about the same percentage of improvement over the 18 x 26-inch as the 18 x 26-inch did over the 19 x 24-inch cylinders, and they have proven entirely satisfactory to us in every respect. As the fundamental principle of power is leverage, we find these engines with the long stroke give us better satisfaction than any other, as we get more leverage from them, consequently more power and better results in every way.

"We use these engines on our heaviest and fastest passenger trains, pulling our New York and Florida vestibuled train, finding no trouble with them over the heaviest grades we have—from 60 to 80 feet to the mile, most of it over heavy curves; 5 and 6 degrees, and extending 7½ or 8 miles, though not all absolutely continuous, making 40 miles per hour with seven Pullman vestibuled cars.

"We find no difficulty in these engines handling our heaviest passenger train of fourteen cars (five of them sleeping cars) 80 miles in two hours and ten minutes or less, making, with this train, five stops for draw-bridges and railroad crossings. This is over a part of the road with light grades.

"I can only say that these two 18 x 28-inch engines give better results in every way than any I have ever seen in my long experience in railroading (twelve years of which were spent as a locomotive engineer); but it is perhaps fair to say that all the results attained are not entirely due to the size of the cylinder, as the outside and inside lap and size of ports have a great deal to do with their satisfactory performance."

Annexed are a few more particulars about the engine:

Total wheel-base of engine—23 feet 10 inches.

Driving wheel-base—9 feet 1 inch.

Wheel-base of engine and tender—49 feet 8¾ inches.

Driving axle journal—8 x 9⅞ inches.

Engine truck axle journal—5½ x 11⅞ inches.

Boiler, type—Extended wagon top, radial stays.

Boiler, working pressure—200 pounds.

Boiler, diameter first course—62¼ inches.

Boiler, firebox length—77 inches.

Boiler, firebox width—33 inches.

Boiler, style of grate—Rocking.

Boiler tubes, number—258.

Boiler tubes, diameter and length—2 inches diameter by 11 feet 2¾ inches long.

Boiler, thickness of shell—⅝ inch.

Slide valve—Richardson.

Slide-valve travel—5¾ inches.

Steam ports—1¼ x 19 inches.

Exhaust ports—3 x 19 inches.

Lap—1 inch outside, 3-16 inch inside.

Exhaust pipe—Single.

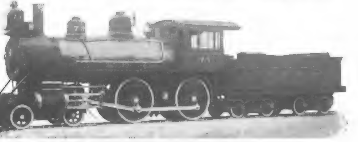
Smokebox—Extended.

Smokebox netting—2½-inch mesh.

Center of boiler from rail—8 feet.

Top of stack from rail—14 feet 8 inches.

Among the special equipment put on these engines are French springs, Westinghouse brake, Latrobe tires, Sellers' injectors, Nathan lubricators, Ashcroft gages, Coale muffled safety valves, United States metallic packing, Keasbey & Mattison magnesia boiler lagging, Leach sander, Gold car heating, Shickle, Harrison Howard's pilot coupler and Tower tender coupler.



FLORIDA CENTRAL & PENINSULAR PASSENGER ENGINE.

The Santa Fé Railroad, which has to make long connections on various parts of its line, has usually carried passengers by stage coach where it would not pay to build a steam railroad. They have now determined to make a trial of gasoline motor-propelled omnibuses in place of stage coaches in carrying tourists from Flagstaff to the Grand Cañon of the Colorado, a distance of seventy miles. If these do the work satisfactorily, the same method of transport will be extended to other points.

A New Train Resistance Formula.

A new general formula for train resistance was published editorially last month in the *Street Railway Journal*, and we are herewith permitted to give an abstract of the article, which, after quoting LOCOMOTIVE ENGINEERING as follows: "We do not believe that it is possible to devise a formula that will show an approximation of the resistance due to different kinds of trains at different speeds when train tons are the basis of calculation," says:

"A general formula which appears to be applicable to passenger trains of all weights, running at all speeds up to the highest limits so far reached, has been lately worked out, however, by John Lundie as a result of a long series of tests of trains in actual service, and is here given to the engineering public for the first time. His methods of obtaining data are decidedly different from, and much more satisfactory than those commonly employed hitherto, where indicator cards of engines drawing trains at constant (?) speed on level (?) track have been made the basis (with an arbitrary allowance for engine friction) of estimates of resistance per ton moved. In order to be of any value such tests must be made in long-distance runs, and it is almost impossible to find a hundred miles or more of absolutely level track for the purpose, while it is also difficult to obtain perfectly uniform speed even on a dead level. Mr. Lundie's method of determining train resistance is based on an examination of the speed curves of a train when coasting from any speed to a dead stop. The possibilities of such a method will be instantly evident to an engineer, and it may be said at once that the results warrant a decided predisposition in its favor. It is not only possible to obtain the gross resistance due to track and journal friction and air resistance combined, but to differentiate between the air and the friction elements. The frictional resistance of a train being reasonably constant within somewhat wide limits of speed, the speed curve should be a nearly straight descending line from full speed to a point somewhere near a full stop. Now the actual speed curve dips below this straight line, as seen in Fig. 2, clearly showing a decreasing retarding force (due to air resistance), with decreasing speed.

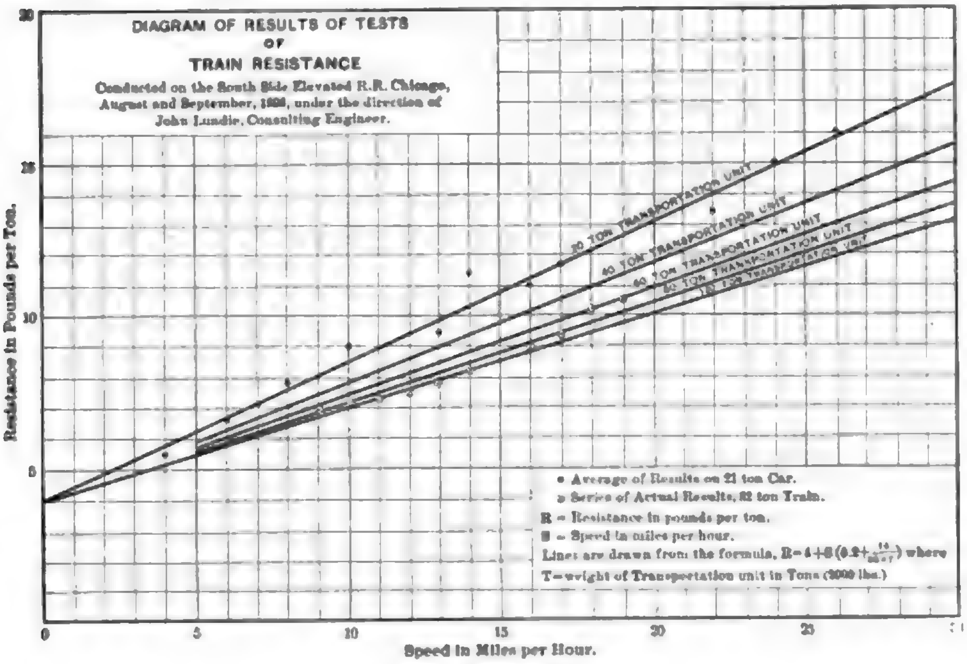


FIG. 1.

"In Fig. 1 are shown in graphic form the results calculated from more than 150 runs made by Mr. Lundie with trains of different weights on the South Side Elevated Railroad, of Chicago. It will be seen that these results, expressed by the location of points on the diagram, cluster around 'straight line curves,' and that these lines intercept each other, with surprising accuracy, at a single point located at a definite distance above the origin. This indicates, of course, that the first step in obtaining the final formula has been reached, in the establishment of a constant, representing the minimum possible train resistance for all speeds and weights, and it is interesting to note, by the way, that in none of the recorded experiments so far made on passenger or freight trains of all weights has the resistance per ton been less than the figure indicated by this constant—4 pounds.

"Mr. Lundie's formula is as follows:

$$R = 4 + S\left(0.2 + \frac{14}{35 + T}\right)$$

where

T = the weight of the transportation unit in tons (2,000 pounds).

R = resistance in pounds per ton.

S = speed in miles per hour.

It will be seen at once that unlike most previous formulæ, there are here two variables after the constant, namely, speed and train weight. Many other investigators have endeavored to accomplish this, but unsuccessfully, and in the formula which has been in most general use in engineering hand-books, that of D. K. Clark, speed only appears as a variable. From a careful study of his results, Mr. Lundie developed the formula on the following mathematical basis: The expression by which 'S' is multiplied is proportional to the tangents of the angles made by the lines developed for different weights, as shown in Fig. 1, and is the characteristic of a rectangular hyperbola which (throughout the range of tests made) co-ordinates quite accurately the relations between train weights and the inclinations of the lines mentioned for corresponding weights. The term 0.2 is an intercept on the axis of y; 14 is the constant product of x and y, with the intersection of the asymptotes as the origin; and 35 is an intercept on the axis of x.

"The test of any formula lies in its application. Gaged by this test, Mr. Lundie's formula unifies in a remarkably close manner nearly all recently published experiments, together with other formulæ of more limited application, as will be seen by an inspection of the accompanying table. The Stroudley, Sinclair and Dudley tests of train resistance scheduled in this table were brought together by A. M. Wellington in the *Engineering News* in 1892, and referred to as intrinsically worthy of confidence on account of the careful manner in which they were made. To these we have added further experiments made on the Philadelphia & Reading Railroad in 1889, and on the Central Railroad of New Jersey in 1892, so that a fairly complete range of train weights from 200 to 400 tons, and of train speeds from 40 to 70 miles per hour is given in the table. The Lundie formula checks up all these tests very closely, though in all but one case the results obtained by its use are slightly higher than the observed results. In this connection it may be noted that Mr. Lundie obtained his speed figures by positive methods, having found that speed recorders for variable speeds are not sufficiently accurate owing to the inertia of the moving parts.

"These tests are all for heavy railroad passenger trains, upon which Mr. Lundie himself has made no experiments. For trains of from 20 to 100 tons, and for speeds of from 5 to 30 miles per hour, the Lundie formula is accurate, inasmuch as it is obtained directly from 150 or more observations made by Mr. Lundie in Chicago, as before stated. For lighter units still, the formula agrees with the

results of private tests made by several of the great electric companies, and checks very well indeed the Clark formula—

$$(R = \frac{S^2}{171} + 7.16),$$

bearing in mind that the latter is generally admitted by engineers to be from 1 to 2 pounds too high.

"Now it need scarcely be pointed out that when a formula of this general kind, deduced on mathematical principles from a large series of experiments within a comparatively narrow range of action, is found to be equally applicable over a much wider range, a strong presumption in favor of the soundness of its underlying principle is established. It seems certain, therefore, that the Lundie formula is thus applicable to the whole range of passenger train traction on straight, level, exposed track in a calm atmosphere. It cannot, however, be said to be applicable to street cars running on gritty or dirty rails, and, in fact, it is unfortunately too probable that no formula whatever can be devised for street railway work for which a large factor of safety would not have to be allowed in practice to provide for great differences in condition of track.

"An interesting question now arises as to whether the Lundie formula can be made, with some modifications, applicable to all kinds of train transportation, freight as well as passenger. It does not check the most recently obtained data for exceedingly heavy trains. Tests on the Chicago, Burlington & Quincy Railway, made by the old method of engine indicator diagrams, checked by dynamometer car, show that a 940-ton train of loaded freight cars, running at 20 miles an hour, has a resistance on a straight, level track of 5.5 pounds per ton. By the Lundie formula this would have been 8.3 pounds per ton. An extremely heavy train of freight cars on the New York Central, weighing 3,428 tons, had an average train resistance, at 20 miles per hour, of about 4 pounds per ton, or the limiting resistance by the Lundie formula as expressed in the first constant. Other tests on fairly heavy freight train work recently made have shown approximately 6 pounds per ton as an average, when track conditions were good, but these results vary greatly with the condition of the track.

"Now it being reasonable to suppose that with the heaviest freight train work, the train resistance will approach the minimum, and the New York Central experiment above referred to, indicating that this minimum is Mr. Lundie's first constant of 4, it would seem that the latter's first constant within the parenthesis, namely, .2, must be inapplicable to very heavy freight train work, and should be, in fact, modified by a variable, probably T. It would be interesting, therefore, to bring together and plot in diagrammatic form, reliable results of a large number of freight train tests taken with different weights and speeds, to see if a modification of the Lundie formula cannot be made for general application to the heavy class of work, as well as light, and we are inclined to believe that were this experimenting once done there might quite possibly be found a common ground of reconciliation between the two grades of service, by which a formula possessing the general characteristics developed by Mr. Lundie could be made applicable to the entire range of railroad transportation.

Test Made by	Year.	On	Mem.	Average Speed. Miles per hour.	Train Weight. Tons.	Train Resistance. Observed.	Train Resistance. Lundie Formula.
William Stroudley	1885	London, Brighton & South Coast	Single test	43.3	376	13.2	14.1
Angus Sinclair	1892	New York Central	Mean of six tests	70.	270	19.08	21.1
" "	1892	" "	Single test	69.6	270	19.8	21.2
P. H. Dudley	1882	" "	Single test	51.48	318	16.9	16.35
" "	1889	Philadelphia & Reading	Single test	60.	242.5	18.35	19.0
" "	1889	" "	Single test	63.5	242.5	19.8	19.9
" "	1892	Central Railroad of New Jersey	Single test	63.2	218	19.0	20.2
Clark formula	....			10	100	7.74	7.04
" "	....			10	200	7.74	6.6
" "	....			10	300	7.74	6.4
" "	....			20	100	9.5	10.06
" "	....			20	200	9.5	9.2
" "	....			20	300	9.5	8.8
" "	....			30	100	12.42	13.1
" "	....			30	200	12.42	11.8
" "	....			30	300	12.42	11.8

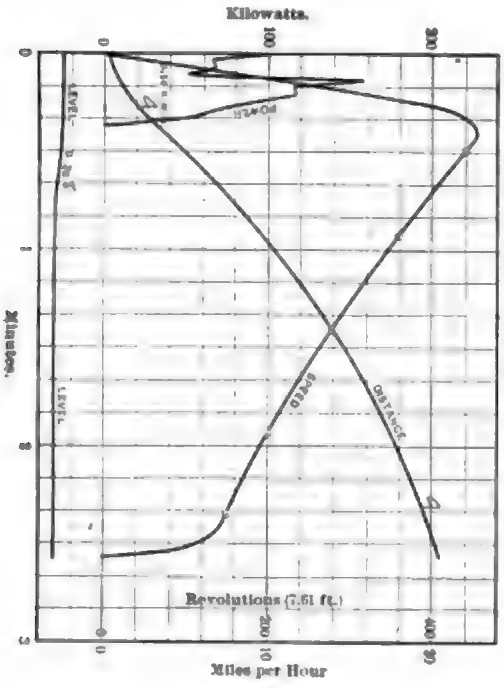


FIG. 2.

Smokeless Firing.

We have received several letters from enginemen discussing smokeless firing, and three have been crowded out for want of room. All are favorable to the system described in our December number, except one from C. F. Sundburg, Sioux Falls, S. D., who flatly contradicts the statements made by several of the Burlington, Cedar Rapids & Northern men, and some of those made by the representative of LOCOMOTIVE ENGINEERING.

Before taking exceptions to statements which were intended to be exact, it is well to be sure of your premises—errors may creep into performance sheets, and you may make wrong inferences even from sheets which are correct.

A ton of coal contains 2,000 pounds and not 2,240, so that our correspondent's calculation for 98 miles at 18 miles per ton should be 10,888 pounds, not 12,200, as he has figured.

In addition to coal consumed while running, figure coal used in firing up and before engine is attached to its train, also for making stops and getting train under headway. Also make due allowance for difference in climatic conditions; the observation and statements apply to operation in September and October, and should not be applied to operations in November.

Better get your information as to effects of light firing from the master mechanic of the Burlington, Cedar Rapids & Northern road. We understand his reports so far have been favorable.

We have received a copy of the Lehigh University Register for 1898-1899. It gives full particulars of the various educational courses and will be found very useful to persons wishing to enter an institution of this kind. It can be obtained from the secretary of the Lehigh University, South Bethlehem, Pa.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Good Instruction Work.

As mentioned elsewhere in this department, the air-brake instruction car of the Nashville, Chattanooga & St. Louis Railroad has been instructing the employés of the W. & A. division for some time past. We are informed that during the time the car was located in Atlanta seventy-four lectures were delivered by Air-Brake Inspector Best and his assistant, at which the total attendance was 3,260. In the examination, out of a total of 60 engineers only one failed to attain a rating of 8. Of the total of 70 firemen the entire body attained the required rating of 7, 10 being perfect. Of 40 conductors only one failed to attain a rating of 7, and of 180 brakemen and other trainmen only two failed to attain 7. The switchmen were passed unanimously. The high ratings shown by these men speak volumes for Air-Brake Inspector Best's method of instruction. Mr. Best was assisted in this work by Mr. M. S. Ransom, assistant air-brake inspector, who has charge of the air brakes in the Atlanta yard.

Not an Unmixed Blessing.

The *Transport*, a British journal, writes thus of a recently introduced air-brake device on an English railway:

"The latest contribution to the solution of the problem of inter-communication in trains is a new device to enable passengers to apply the continuous brake to a train in cases of emergency. Mr. Worsdell, the locomotive superintendent of the North-Eastern Railway, is the inventor of the apparatus. It is worked by a lever in each compartment; this, when pushed up, releases the air in the Westinghouse brake pipe, and thus brings the brake into action, at the same time causing a whistle under the carriage to blow until the guard, by means of a key, restores the handle of the lever to its normal position. The guard is in this way able at once to locate the compartment in which the passenger who has made use of the apparatus is traveling. The appliance can also be used in connection with the automatic vacuum brake. There is nothing very new, of course, in the idea of this apparatus, and it is looked upon with disfavor by many of our railway authorities, who object to allowing passengers command over the progress of a train."

We are always glad to receive news of the work of air-brake instruction cars.

Double-Line Air-Brake Systems.

As has been stated in these columns, an air-brake system which requires two lines of train pipe cannot successfully compete in a commercial sense with the standard form in use to-day. The additional advantages furnished by a double-line system must necessarily be very great to offset the simplicity and comparatively inexpensive maintenance of the single-line system. None of the double-pipe systems so far brought out succeed in furnishing any increased efficiency, but, on close analysis, will be seen to be much less efficient than the standard form.

Experienced air-brake men realize and concede that real improvements in air brakes must be made along the line of single train-pipe systems, and not by inventing double-line systems.

CORRESPONDENCE.

Air-Brake Service on Heavy Grades.

Editor:

Last year A. L. Humphrey, superintendent of motive power; B. H. Bryant, superintendent, and S. S. Morris, trainmaster, of the Colorado Midland, inaugurated a new system of holding trains down our 3 and 4 per cent. grades without the aid of hand brakes.

The brake levers were adjusted to give proper piston travel on sixteen cars loaded with coal at the top of a twelve-mile hill of 4 per cent. grade. Pressure retainers were all tested; train started down without any hand brakes set; engineer was instructed not to exceed twelve miles per hour. It has proved to everybody that it is a success; not as many flat and broken wheels as were had very frequently under the old system of running fifteen miles per hour and stopping half-way down the hill for twenty minutes for wheels to cool. Better holding trains, less work for the brakemen, and, best of all, saving dollars for the company.

It has been the opinion of a great many trainmen that it was impossible to hold trains down 3 and 4 per cent. grades without the aid of hand brakes. This proves conclusively, however, that properly adjusted levers and pressure retainers that retain the pressure long enough to enable the train to be properly recharged make the best holding trains. FRED STIFFLER,

Colorado Midland Ry.

Thomasville, Colo.

An "Obermachinenbaumeister's" Report—Piston Travel in Germany.

Editor:

Following is a story of a German master mechanic on adjustment of piston travel in Germany:

General Inspector—Inspector, you should on this car at your terminal the piston travel at 6 inches set, and the inspector at the other terminal should it likewise do.

Inspector—Yes, your excellency; but as the other terminal has no inspector got, I myself have the piston travel made 12 inches for the round trip.

FRITZ PUMPERNICKLE.

St. Louis, Mo.

Chamber D and the Emergency Position.

Editor:

Suppose that a man was called on short notice to take a passenger engine, and when he was taking his engine to the train he found that no preliminary exhaust could be obtained. Assume that he had no time to correct the matter at all.

With the brake valve that he has (D-5 or 1892 model), there is a groove on the under side of the rotary, which, in the emergency position of the valve, conducts air from chamber *D* to the atmosphere, thereby causing the black hand of the gage to fall as the pressure is reduced. The person with whom I disagree claims that satisfactory braking can be done by watching the black hand in its reductions, the same as in the service application. I claim that, in the emergency position of the brake valve, there is no definite connection between the pressure above the equalizing piston 17 and the train-line pressure, and that much uncertainty would arise from depending on the black hand in such a case as this.

I submit this to you in order that you may or may not confirm me in my belief through your columns of the LOCOMOTIVE ENGINEERING. B. B. MILNER.

Emporia, Kan.

[The black pointer could not be depended upon in this case, as that pointer does not mark train-pipe pressure when brake is operated in the emergency position. The brake valve would have to be very carefully operated in the emergency position without any reference to the air gage, and, of course, unsatisfactory results would be had.—Ed.]

Sixth annual convention of Air-Brake Men, Detroit, April 11th, 12th and 13th

Noiseless Air-Pump Exhaust.

Editors:

Replying to your editorial in November issue of LOCOMOTIVE ENGINEERING, relative to loud-sounding air-pump exhausts. We herewith enclose you cuts and a description of our patented device which is now on trial on several roads in this section of the country. The following is a description of our device:

It will be seen that exhaust pipe branches off near the pump, one pipe leading to the front end near the smoke-box, then branching off again, each pipe leading to live-steam ports or steam chests; said pipes being supplied with check valves located near the steam chests. The other pipe leading over cab into the condenser, coils in the tank.

When the engine is working steam in ports are provided with automatic drip valves situated at the lowest point under the cylinder saddle, which drain condensation from the air-pump exhaust when the engine is at rest.

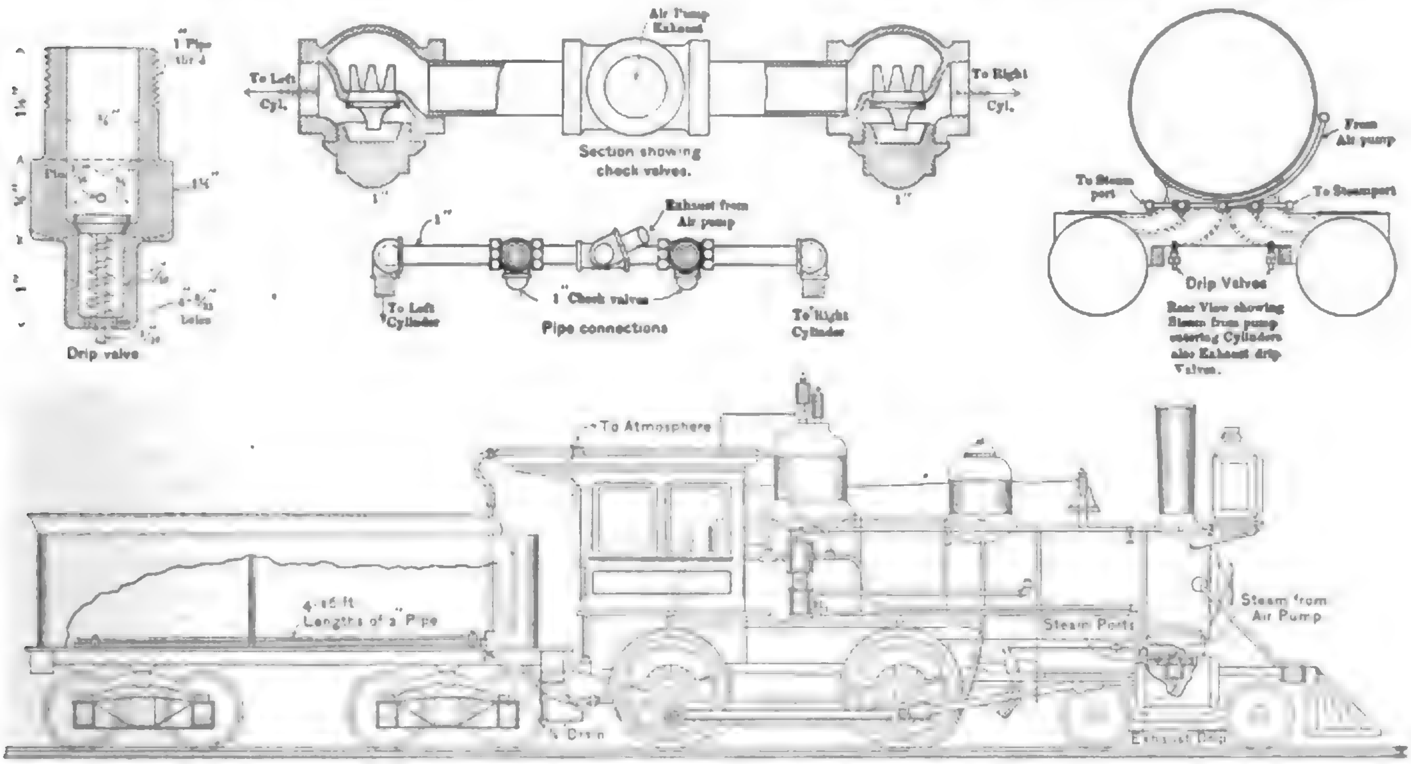
This device is perfectly noiseless, does not annoy passengers nor frighten teams around stations.

It saves fuel, as it does not create a draft on fire when air pump is working, as does the old method of putting exhaust in stack.

It acts as a lubricator to cylinders and valves when engine is not working steam. The exhaust steam and oil from air pump circulate in steam chests and cylinders, keeping them at a uniform temperature, not chilling off in cold weather when engine is at rest, nor overheating, burning off oil on cylinder walls, nor cutting cyl- pump exhausting into the condenser acts as a feed-water heater, taking waste steam to heat feed water, thereby making a freer steaming engine and effecting a saving of fuel. Water in tank being warmer than atmosphere, tank never sweats, thus preserving life of paint on tank and keeping it bright and fresh. It also prevents the rusting of iron in the coal space of tank, caused by the combined action of moisture and coal.

This device is automatic in its operation, simple and cheap in its construction, and we guarantee it to make a saving of 50 per cent. in cylinder oil and 2 per cent. in fuel.

We give below a record of Chicago, St. Paul, Minneapolis & Omaha Railway engine 160, before and after being equipped with this device. The general average for



NOISELESS AIR-PUMP EXHAUST AND FEED-WATER HEATER.

the cylinders, the check valves in the branch pipes close automatically, throwing the exhaust steam from the air pump through the pipe leading over the cab and into the condensing coils in the tank. The extreme ends of said coils are provided with a drain-cock, leading through bottom of tank, thereby providing a means for the condensation to escape.

It will be seen that the exhaust pipe leading over the cab is provided with a three-way valve, thus providing a means of throwing exhaust steam to the atmosphere at the will of the engineer. When steam is shut off from the cylinders and engine is at rest, or drifting down grade, the check valves in the exhaust pipe from the air pump open automatically, letting exhaust steam from the air pump into steam chests and cylinders. Live-steam inders when engine is drifting down grades, by friction of piston traveling to and fro. This appliance reduces the wear on valves, valve seats, cylinders, etc., to a minimum, by perfect lubrication.

It is beneficial to the working of air pump, as there is a partial vacuum formed in steam chests and cylinders when engine is drifting down grade shut off. A partial vacuum is also caused in the exhaust pipe from the pump when the engine is working steam in cylinders and air pump is exhausting into condenser in tank. This does away with back pressure entirely and gives a free working pump.

The relief valves or suction valves on steam chests can be dispensed with, as the air pump exhausting into same performs their functions.

When engine is working steam, the air five months prior to the engine being equipped was 19.4 miles to ton of coal and 106.3 to pint of valve oil. General average for eleven months with air-pump exhaust in tank and cylinders, 28.7 miles run to ton of coal, 245.9 miles to pint of valve oil. These reports were copied from performance sheets issued monthly by the C., St. P., M. & O. R. R. Co.

WALLACE & KELLOGG.

Altoona, Wis.

A strong inducement to hang up the hose in the new dummy coupling now furnished by the Westinghouse Air-Brake Company, and illustrated in this department last month, is the fact that the center piece of the dummies which fits into the coupling gasket keeps the gasket pressed upright and in good condition.

Device Which Recharges While Brakes Are Set.

W. T. Hamar, Atlanta, Ga., has been granted a patent for a device which recharges the auxiliary reservoir while the brakes are set. This is the latest of the numerous recharging devices. Its operation is as follows:

Fig. 1 is a longitudinal section through the ordinary triple valve of an automatic air brake, showing the double-seating valve in the main piston 9, which constitutes the invention. Fig. 2 is a sectional detail, on a larger scale, of the double-seating valve; and Fig. 3 is a similar view showing another position of said valve.

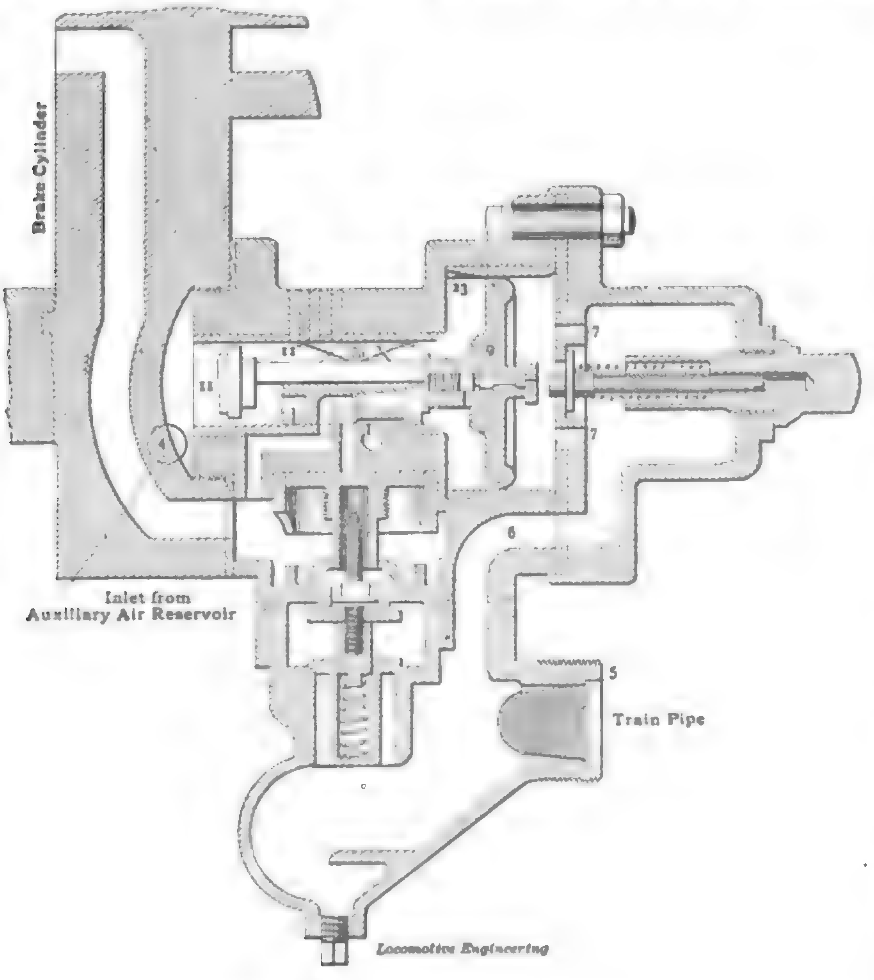


Fig. 1

DEVICE FOR RECHARGING WHILE BRAKES ARE SET.

The patent consists of a double-seated valve, Figs. 2 and 3, located in the hub of the main piston 9, as shown in Fig. 1. This valve consists of two heads a^7 and a^8, closing alternately over a port a^6 on the brake side of the piston, a stem A', rigidly connecting the heads; a spiral spring a^4, surrounding the inner end of the stem and located between the head a^8 and the inner closed end of the hub, and a head a^3, fixed on the outer end of the stem, closing an opening a' in a detachable cap A, and having radial arms or cut-away periphery to guide the stem and still allow air to pass when it leaves its seat over the opening a'. The head a^8 closely fits the bore of the chamber all around, while a^7 closely fits it over the port a^6, but has a cut-away periphery or port a on its upper edge to let air pass.

The valve is made removable, as shown in Figs. 2 and 3, by screw-cap A, as is also the spring coiled around its stem at its inner end, said spring holding the valve to its seat at a', as shown in Fig. 2, and preventing any flow of air from the train pipe through port a' and ports a and a^6 when the piston is in its normal position of brakes released or on the extreme left and in the plane of a passage 23, with the pressure equalized on both sides of the main piston.

Referring to Fig. 1, the piston, as shown, is in the position of brakes applied and the double-seated valve is closed to both train-pipe pressure at a' and auxiliary pressure at a^6, the head a^8 performing the functions of a valve and closing port a^6. The engineer now, desiring to recharge his auxiliary air reservoir, places his valve on the engine in a position to admit air to the train pipe, which enters the triple valve at the train-pipe connection 5, passing through ports 6 and 7 into main piston-chamber, forcing valve heads a^3, a^7 and a^8 from the position shown in Fig. 2

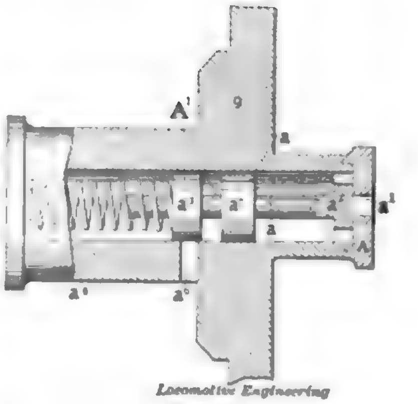


Fig. 2

with a partial range of movement which leaves the port a^6 between the heads a^8 and a^7, thereby establishing communication from train pipe to auxiliary air reservoir through port a', a and a^6, and thence through slide-valve chamber 11 and inter-pipe 4, leading to auxiliary air reservoir. The pressure becoming equalized, spring a^4 restores valve to its seat, as shown in Figs. 1 and 2. This valve has a pulsating action responding to slight increase of pressure on its train-pipe side and closing by its spring-tension when pressures are equalized on both sides of piston 9, the piston 9 being the dividing line between train-pipe and auxiliary pressure.

In making a final and full release of the brakes, the engineer places his valve in the full-release position, throwing the excess pressure into the train pipe, the air taking the same course as usual and forcing the double-seated valve to the extreme limit of its travel, compressing the spring, as shown in Fig. 3, and valve-head a^7, closing port a^6, allowing no air to pass by the valve to the axiliary reservoir in the position of brakes released. The spring then restores the double-seated valve to its normal position, as shown in Fig. 2, in which it is closed to both train-pipe and auxiliary reservoir.

In the position of brakes released, the piston 9 is moved inwardly, opening passage-way 23 on opposite sides of the piston 9, and allowing air to flow past piston 9 to auxiliary reservoir as provided for by the Westinghouse system.

We will pay 50 cents and 75 cents, respectively, for paper-bound and leather-bound copies, in good condition, of the St. Louis Proceedings of the Air-Brake Men's 1895 Convention. Persons desiring these copies may have them at same price by sending ten cents for postage.

Fig. 3

Use of Sand—Rail Cleaning Device.

On page 563 of the December issue of LOCOMOTIVE ENGINEERING there appeared an able article by E. W. Pratt, on "Who Slides Wheels?" embracing some good suggestions relative to "how to overcome the sliding of wheels on fast trains and bad rail."

Each of us would gladly welcome the solution of this subject, but it seems to be one upon which even experts may honestly differ.

The Air-Brake Association recommends one application, using sand, when necessary, to create the adhesion required, and seems disposed to hang fast to that theory; while others believe two applications on sand safer, and less liable to slide wheels.

Engineers, as a rule, object to using sand from the initial reduction at high speed, from the fact that to them it seems a waste of that which may be very precious for other purposes before the trip is completed, and also that it has a tendency to cause the engine to warm up somewhere.

Running at a rate of 60 miles an hour, we know that the velocity of the wheels—i. e., the force that keeps them revolving on the rails—is four times greater than the braking power if fully applied; gradually decreasing, of course, as the speed is being reduced, until *just before* the final stop, when they are about equal. This, of course, is on good dry rail. It would seem from this (and practice will demonstrate it) that we have a good, safe margin in following Mr. Pratt's suggestion about two applications, in the manner he describes—but omit the sand on first application. It may be used to good advantage on last, or final, application. But if we are passing over muddy crossings at low speed, it is better to waste a little more air and time than to use hand, unless it is used very judiciously.

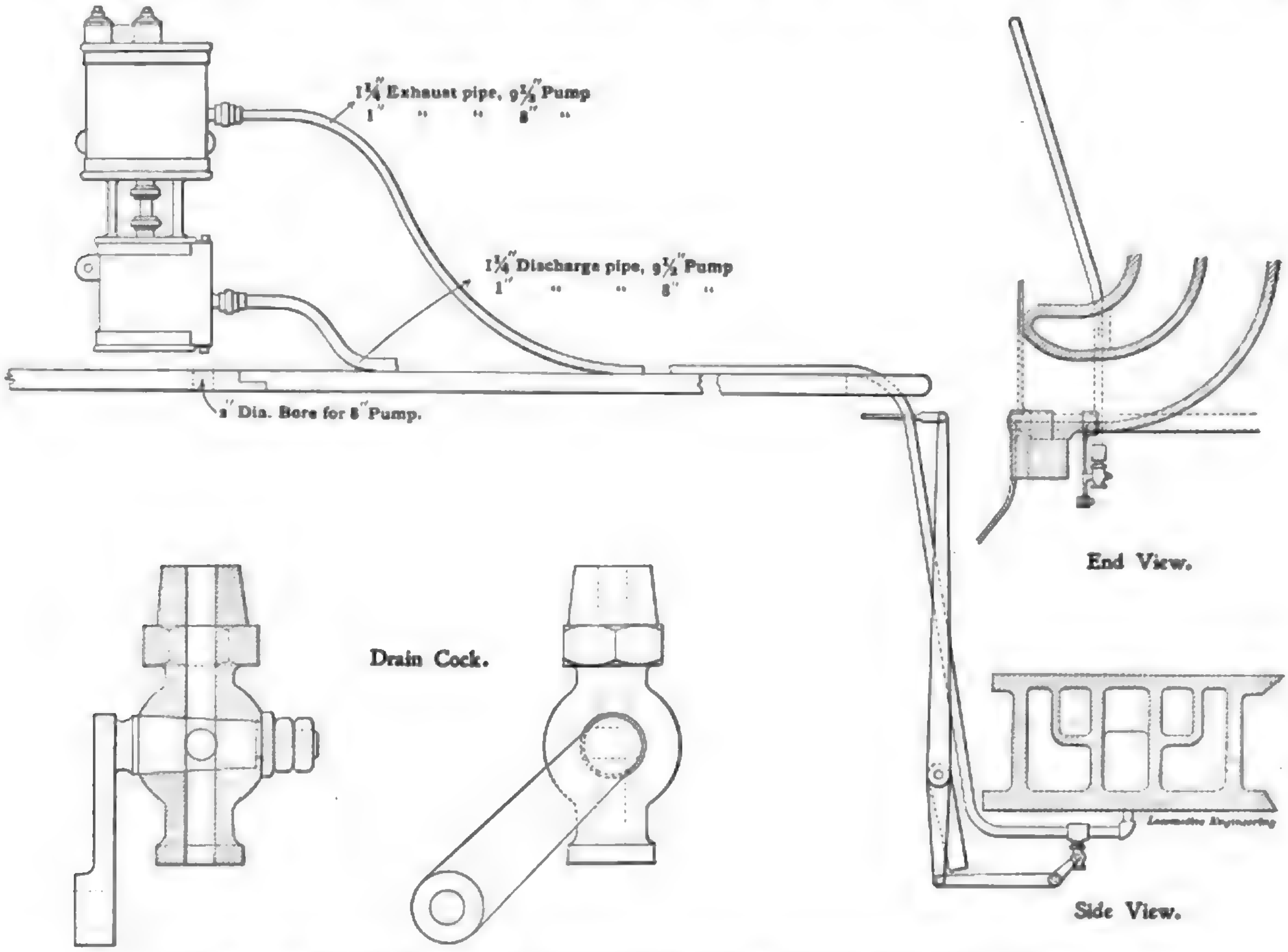
Sand and mud, at best, do not go well together, and form an admixture that will do more damage to wheels than any other known agency; frost and sand being a close second.

The writer, while on a recent trip, was much impressed with a device he saw used extensively on one of the trunk lines in the South. It was called a "rail washer," and was gotten up to wash the sand off the rail behind the engine. For three reasons it proved a great success. First, it enabled freight engines to haul one more car, from the fact that the sand was removed from the rail, and thereby reducing the friction to a minimum; second, it kept the boiler from priming, by acting as a surface cock; third, by thoroughly cleansing the rail, it prevented, to a large extent, the sliding of wheels on frosty, muddy or greasy rail.

The contrivance consists of a pipe introduced into the boiler, in lieu of second gage cock, with ¾-inch opening and with globe valve; the end of the pipe pointing towards the rail being peened down to ⅛-inch opening.

It is a well-known fact that, in point of adhesion, a clean, wet rail is almost equivalent to the best dry rail; and by using two applications in conjunction with the "rail washer" it seems there would be no danger, whatever, of sliding wheels.

M. W. BURKE,
Moberly, Mo. Wabash R. R.



SYSTEM USED ON THE CHESAPEAKE & OHIO RAILROAD FOR DISPOSING OF THE AIR-PUMP EXHAUST.

Disposing of and Utilizing the Air-Pump Exhaust.

Editor:

In looking over the last few numbers of LOCOMOTIVE ENGINEERING, the writer has been struck by quite a number of articles on the air-pump exhaust.

Most of the writers appear to favor piping the exhaust into the exhaust pipes of the locomotive. This no doubt is a very good plan; does not draw on the fire so hard, and does not make very much noise. The objection to this plan, however, is

that while standing at a terminal point or making a long stop at a station, the exhaust condenses, and the water and oil lie in the exhaust pipes until the engine is started, then the water and oil are thrown all over the engine.

The Southern Pacific (Pacific System) have some locomotives fitted up in this way, but they also have a large 1-inch cylinder cock put in the pipe where it branches to the exhaust pipes. This cylinder cock is worked from the cylinder-cock rigging, and when standing at stations it can be opened and the exhaust turned under the engine. This, however, makes considerable noise.

The best way the writer has ever seen to get rid of the air-pump exhaust, is to pipe the exhaust pipe underneath to the exhaust pipes, and screw a "T" up into the exhaust pipes of the engine. Then on the front of the "T" put in a check valve, so the exhaust from the pump will raise it. Then extend the pipe around in the front of the cylinder saddle, and drill through the saddle into the steam pipe and connect the pipe into the steam passage. Then when standing at a station or terminal, the water and oil go into the steam chest and cylinders, where they will do the most good.

This is also a fine thing for roads that have long heavy grades, as the exhaust helps to lubricate valves and cylinders.

Mr. Wm. Hancock, the master mechanic of the Santa Fé Pacific, at The Needles, Cal., has a patent on this. I am sure that he will give any road the right to use it for a small consideration.

The writer has been at The Needles when an engine came in from Peach Springs, 110 miles down a 2 per cent. grade. The cylinder heads and steam-chest lids were taken off, and every part was moist and showed plenty of lubrication.

This apparatus was placed on a certain Western road, on a division that was 83 miles down grade, and a 2 per cent. grade. It was put on one ten-wheel engine, 20 x 26 inches; one twelve-wheel engine, 22 x 29 inches, and one twelve-wheel compound, 20 x 30 x 26 inches. The cylinders were calipered carefully and a record kept. The engines were run a year, and at the end of that time cylinder heads were taken off, and the wear of the cylinders was hardly perceptible.

With the ten-wheel engine, the engineer told me that he had invariably to oil the valves through the lubricator cups to keep the cylinders from groaning coming down this long grade; but after this apparatus was put on he never had to put any oil in, only what was fed through the lubricator.

I consider this a very fine thing even for level roads, because when the engine is shut off running into a station, the valves and pistons get the benefit of this extra lubrication, and it is not wasted. The Santa Fé Pacific road is putting this device on all their engines.

HARRY C. FRAZER.

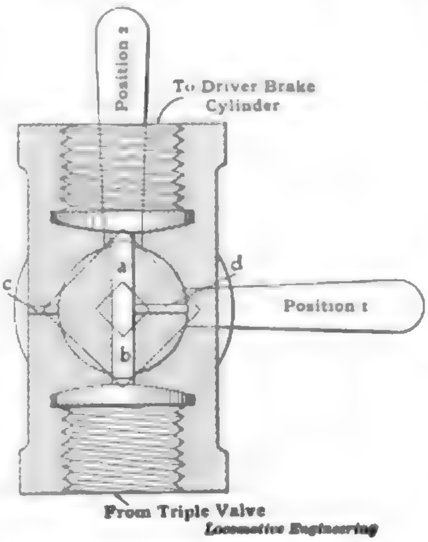
San Francisco, Cal.

Driver-Brake Release Valve.

Editors:

Enclosed find a simple device for releasing the driver brake when brakes are set on the train. This is especially useful on long freight trains, or making water tank stops, on heavy grades; or on bad rail you can release your driver brake without interfering with any other brakes on the train.

The sketch shows the device in position 1 where the cock is inoperative. When placed in position 2 the auxiliary reservoir



DRIVER-BRAKE RELEASE VALVE.

is cut off, and the brake cylinder is communicated to the atmosphere through ports *d*, *a* and *c*.

W. O. PARKER, A. B. Repairman,
Coast Div. Sou. Pac. Ry.

San Francisco, Cal.

[This device is of the kind recommended by the Air-Brake Association when one becomes necessary on long steep grades, and being in the pipe between the triple valve and brake cylinder is about the only form permissible, inasmuch that its use allows the triple to keep the auxiliary reservoir charged at all times. Driver brakes, however, should never be cut out on account of bad rail, because the holding of the cut-out vehicles must be done by those left cut in, and increases the tendency of sliding of wheels on the latter.—Ed.]

Larger Main-Reservoir Capacity Urged.

Editor:

In the February number of LOCOMOTIVE ENGINEERING I notice that the main reservoir capacity or volume has come in for a fair share of recognition, and also a very interesting letter regarding the method of increasing the volume of main-reservoir pressure in cases of double-heading, as practiced on the Chesapeake & Ohio. This all seems to me to be perfectly proper, and the wonder is, when we stop to consider the advantages to be obtained from ample main-reservoir capacity, that we do not find them much larger than we do, even on the large engines that have recently been turned out of the works.

It is becoming quite common to see engines hauling sixty-five and seventy cars all alone on roads where the grades will permit, and the majority of these equipped with air brakes, coupled and working. Now, when the engineer uses good judgment and things are in pretty good shape, no very great difficulty is experienced in handling them with reservoirs of present capacity. It is when we break in two or want to release after an emergency application, or to let them down a long incline, that the big main reservoir is a decided help.

I believe that the heavy freight engines of to-day, weighing as they do, anywhere from 250,000 to 300,000 pounds, should have at least 70,000 cubic inches of main reservoir capacity.

With this volume we could afford to cut down the "excess" somewhat, thus increasing the efficiency of the pump, and also rendering it less likely to heat on account of the lower tension of the air it has to work against; then there would be the saving to air-brake hose and triple, for in releasing, the air would go back with less energy, and there would not be the likelihood of hose rupturing.

While the foregoing are advantages worth striving for, there are still others fully as important. Take, for inst nce, a train of sixty or seventy cars that we wish to charge and test the brakes on, and cannot do so until the engineer backs onto them. We could charge them up in a very short time with the large reservoir, while with the small it would take considerable time, and time is one of the things we want to save as much of as possible. In the release of the brake, the chances for a brake sticking near the rear end, whose piston travel may be a little short or the triple packing ring leaky, would be very much reduced.

On some roads I notice a lack of confidence evinced in the ability of the air brake to handle trains safely on grades, but if we had large reservoirs on the engines, there would be no danger of us losing our air and the train getting away from us; always providing, of course, that we have a share of the retaining valves to help us.

Mr. Morris' scheme to connect both pumps and reservoirs in cases of double-heading, seems to me to be a very good one, and must result in a big saving of time when charging the train, as well as rendering the handling of it much safer and pleasanter while on the road.

J. P. KELLY.

Pittsfield, Mass.

Charging Empty Trains.

Editor:

It is customary here after making up a train to depart from a terminal to couple all the air hose and turn the angle cocks in line with the train pipe before the engine is coupled on. All the engines have the required train line and main reservoir pressure pumped up before coupling on to the train.

When the train pipe and auxiliaries are charged up on a twenty to thirty-car train, with their many small and sometimes large leaks, it requires the pump to work too hard and long before all the leaks are stopped. As the train has to be charged to find the leaks, I think it would be a good plan not to cut in the angle cocks with train line until after the engine is coupled on, and then cut in one car at a time. Then if a leak occurred the brakeman or inspector could stop it at that place, and about the time the inspector went from one end of the car inspecting it that car would be charged, and so on until the last car was examined.

As there is seldom more than one man to look after a thirty-car train, and the time he finds all the leaks and goes after the material the pump is working uselessly to supply the leaks. Is my idea wrong? JAS. F. MCGARR.

Engr., K. C. Div. of L. & N. R. R.

[There would be much more pumping required by cutting in one car at a time, for the reason that each time an additional car was cut in and charged the head brakes would apply and necessitate the use of main reservoir pressure to release and recharge them. As the cars near the rear end were cut in, the air used by the brakes ahead in setting, releasing and recharging would be much greater than the amount escaping from the leaks in the present method.—Ed.]

Appreciated Air-Brake Instruction.

Editor:

The Nashville, Chattanooga & St. Louis air-brake instruction car was located in Atlanta, Ga., from the latter part of November till January 31st for the purpose of instructing the employés of the W. & A. division of that road in the construction and operation of air brakes. Mr. Otto Best, air-brake inspector of the Nashville, Chattanooga & St. Louis Railroad, and treasurer of the Association of Railroad Air-Brake Men, has had charge of the car.

On the 25th of January the engineers and firemen of that division, in token of their appreciation of his courtesy and genial method of instruction, presented Mr. Best with a fine china dinner service. Mr. John A. Welch, one of the oldest and most popular engineers on the division, made the presentation speech, and was followed by Mr. M. L. Collier, M. M.; Mayor Woodward, Chief of Police Manley, Chairman of the Board of Police Commissioners Johnson, Alderman Broyells and Councilman LaHatt, who each made a few remarks suitable to the occasion, after which Assistant Superintendent C. S. Evans presented Mr. Best with two boxes of extra fine plug cut tobacco.

It is a singular coincidence that, wherever Mr. Best goes he gets acquainted with the chief of police. But joking aside, it is quite complimentary to him and to the management of the road that such good feeling exists among the men. "N. C. & St. L."

Atlanta, Ga.

Simple Device for Removing Feed-Valve Pistons.

Editor:

I have a little wrinkle for removing feed valve pistons which I have never heard spoken of, and which may help someone out who "can't get tools made."

I just cut off a reversing-valve stem of a 6 or 8-inch pump the right length, so that when the button on the end of the stem bears against the top end of the feed-valve piston, the other end will bottom in the guide for feed-valve stem on the cap nut when the cap nut has entered about three threads. Then screwing the cap nut the rest of the way down will usually force the piston out without damaging any of the parts. JOHN M. THOMAS.

South St. Joseph, Mo.

Mr. T. J. Henderson, 2996 Twenty-third street, San Francisco, Cal., writes us that he is patentee of a successful working automatic air brake for electric street cars. His brake is in service on the S. F. & S. M. Street Railway, making good mileage, and will be fully explained to inquiring and interested persons if they will write Mr. Henderson.

Correspondents should always give their address when writing. Frequently it is necessary to communicate with correspondents to obtain further data. We hold a communication from George Rich, New York City, and a returned letter sent him. Will he kindly write us again, giving more specific address?

"California" is the name of a beautifully illustrated hand book of travel recently issued by the passenger department of the Burlington route. It contains seventy-two pages of artistically printed matter, put on a very fine grade of paper. Nearly every page contains one or more excellent half-tones of scenes that people witness in California and on the way to it. It also contains a great deal of information that will be found useful to people likely to visit California, and is well worth sending for. We believe that the passenger department of the Chicago, Burlington & Quincy will send the book to anyone asking for it.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(16) W. H. S., North Platte, Neb., writes:

What effect will it have on brakes if pin that holds graduating valve comes out? A.—On short trains, or if the triple is not well cleaned and oiled on longer trains, quick action will usually follow if a service application is made. On longer trains with the triple in good condition, the train-pipe pressure is reduced so slowly that quick action is not so likely to ensue as with shorter trains.

(17) W. H. S., North Platte, Neb., writes:

Plate B-25 triple valve on a car; leakage groove in brake cylinder cleaned and in good shape. As soon as the auxiliary and train pipe were charged the brake piston would move out 4 or 4½ inches. Put on new triple and it worked all right. What was the matter with the old one? A.—This was a plain triple valve for freight cars of the old pattern. See answer to Question 21 for this case.

(18) J. T., St. Joseph, Mo., writes:

Triple valve (plain) is connected to driver brake cylinder by tee and nipple screwed into cylinder, one lead of tee going to other cylinder and other lead to triple valve. I have always seen pipe from triple run to about midway between cylinders, so as to have same length of pipe to each. Do you think this difference would do any damage? Could it injure driving axles from one side going on before the other? A.—No. Pressure will be had in both cylinders practically at the same time.

(19) E. O. P., St. Albans, Vt., writes:

How should engineers proceed when coupled "double header" with passenger engines so that the signal whistle will be operated on both engines. Will the car discharge valve exhaust enough air from signal line to overcome the pressure supplied by two reducing valves? A.—A clear car discharge valve will make sufficient signal line reduction to blow the whistle on both engines. Some roads, however, practice cutting out the reducing valve on second engine, but this is not absolutely necessary unless the train is very long and the car discharge valves are not clear.

(20) W. W., Temple, Tex., writes:

Please advise whether chamber *D* air feeds to train pipe via feed valve when rotary valve is in emergency position, the 1892 model valve being used? A.—With the rotary in extreme emergency position there are two outlets for air from chamber *D*—through the feed valve to train pipe and out at emergency exhaust, and through ports *p* in the rotary face and *h* in the seat. Air probably goes as rapidly through one as the other, with the preference for the last mentioned, as that is brought in play the moment the handle leaves service position, and the

latter is not until the handle is in almost extreme emergency position.

(21) W. H. S., North Platte, Neb., writes:

I had a car the other day with a Plate B-9 triple valve; train pipe tight. As soon as auxiliary reservoir and train line were full of air, and stop-cock closed on both ends, the brake would set. I put on a new triple valve and it worked all right. What was the matter with the old one? A.—This was a plain triple such as is used on tenders. Either auxiliary-reservoir air or train-pipe air went to the cylinder. Auxiliary air could get there past a leaking slide valve or seat, or by leakage of train-line pressure at the triple-valve cap gasket or three-way cock. Train-line air could go direct to cylinder if the three-way cock leaked around the plug.

(22) L. P., Lakeland, Fla., writes:

Engineer noticed air gage and saw he had as many pounds of air as he had of steam. When he applied brakes, instead of air, steam came out of train-line exhaust. He bled main reservoir and steam continued to come out, and hose pipes and main reservoir were hot, and fireman got burned by an air pipe in cab. A.—Unless some special steam connection is made to the air-brake system, steam cannot get into it except through the pump governor, if all escape ports are plugged and diaphragm valve leaks, or through the air pump. Occasionally a hollow piston rod is found which has a flaw at the lower end and allows steam to pass into the air cylinder and main reservoir, thence to the train line.

(23) H. L. H., Pensacola, Fla., writes:

Why is it that after coupling to a train of fifteen or twenty cars with the plate D-8 brake valve and after reducing 10 to 20 pounds from train line that the exhaust doesn't stop until train pipe is empty? The equalizing reservoir, its connections, the gasket above the equalizing piston and the rotary valve were tight on this occasion. But with a short train or the engine this trouble didn't occur. A.—The train-pipe pressure has probably been reduced lower than that in brake cylinders and auxiliaries, and air is leaking back through the emergency check valve or triple valve cap gasket. On fifteen or twenty cars this back leakage would be considerable, and would raise the equalizing piston and escape. On a few cars the back leakage might not be noticed, maybe balancing train-pipe leakage, and would not raise the equalizing piston sufficiently to make a noise.

(24) J. E. W., Cumberland, Ind., writes:

1. Why is it that all improved 1-inch and ¾-inch governors will not work alike? Some of them will stop the pump dead, others will not do it. I have taken a governor off an engine that would not shut off and stop the pump and put it on an engine that the governor did stop the pump, and it would not stop it, thus demonstrating that the trouble was in the governor. I know they are not intended to stop for any length of time, but they are not sensitive enough and will let the pump work too hard. Will you please tell me how to remedy these governors? A.—The steam valve has not been ground in until recently, as the manufacturer believed the joint to be sufficiently tight as it came from the lathe, but experience has proved that grinding is necessary; therefore, all steam valves for governors have been ground in since last September. Grinding will probably cause your trouble to disappear.

(25) J. C. L., Jamestown, N. D., writes:

The following air-brake question is on a switching engine. The main reservoir is on back-end tank. Engine has no driver brake; has plain triple valve and D-8 brake valve. When brake is applied in service or emergency, brake will not set; but when thrown in release will set brake, and if left alone for five minutes will release itself. When angle-cock is open at rear end, tank brake will set. Triple all "O. K."; no signal pipe on engine; no excess can be pumped up on gage. What is the trouble with this air? A.—Hose between engine and tender has been coupled up wrong. The pipe from the main reservoir on back of tender has been coupled to train pipe of engine, and main-reser oir pipe on engine has been coupled to train pipe of tender. Thus with handle in service or emergency position, the air escaping at the brake valve comes from the main reservoir, and the train-pipe pressure is held. Now, with handle put in release position, air from the train pipe will flow into the main reservoir, which is lower than the train pipe in this case, and brake will set. Leave handle in full release position a few minutes, and brake on tender will pump off as all parts are in communication from the pump to back end of tender. No excess can be had, because all air going through the brake valve goes through backwards. In this case no excess, of course, can be had unless the handle is placed in running position before governor pressure is reached; then excess will show on black hand.

The Steel Tie Making Its Way.

Wood suitable for railroad ties has long been scarce and dear in Europe, and the consequence is that many railroad companies use metal ties. This practice began more than twenty years ago; but the first forms tried were so unsatisfactory that the metal found little favor, and many companies turned to processes that would prolong the life of wooden ties. This arrested for a time the progress into favor of metal ties; but it was only to the time that satisfactory forms were designed, and now-a-days one seldom sees any new wooden ties on continental railroads.

In a paper read at the International Railway Congress by Mr. Renson, interesting details of experience on a Belgian railway with different ties were given:

"For comparison, a part of the road was laid with oak sleepers, and identical conditions assured as to nature of road-bed, drainage, weight of rail, care in maintenance, etc. The metal ties varied in shape and quality, from the crude forms of the earliest ties to the more scientifically designed later article. It was found that the average life of the oak ties was thirteen years, while the average life of the earliest and crudest metal ties was eighteen years. The later ties have their width decreased and their vertical flanges deepened at the center, thus providing a maximum bearing surface immediately beneath the rails, and increased girder depth at the center; and by the use of round drilled holes for the fastenings and inserting plates between rail and tie, the life of the latter was greatly lengthened. M. Renson states that, economically, and on every point of comparison, these experiments proved the superiority of the metal ties."

The Right Depth of Firebox.

The question of depth of firebox or distance from grate to crown sheet is one of interest and value to designers, although the varying depths we find in practice seem to indicate that almost any depth will do.

This does not seem to be the case, however, as indicated by experiments on the engine "Montour" of the Lackawanna & Bloomsburg road in 1862 and 1863. The "Montour" was a wood burner, 16 by 22-inch cylinders, 5-foot drivers, and used in freight service. The firebox was 66 inches deep from grate to crown sheet.

When the engine was changed to a coal burner the grate was raised 10 inches, leaving the distance from grate to crown sheet 56 inches, and a fine steaming engine resulted.

The next step was to raise it another 10 inches, leaving it 46 inches between grate and crown sheet, and it wouldn't make steam enough to do its work. There seems to be a right point for best results, which allows the proper mingling of gases to produce the hottest flame against the crown sheet and the most heat in the tubes.

The Lukenheimer Company, Cincinnati, Ohio, have favored us with a copy of their slide-valve chart, together with a neat little book by Mr. R. Conway, M. E., giving plain instruction for setting valves by the aid of the chart. It appears to be a simple and practical method of analyzing the movements of the slide valve, and should prove of value to anyone interested in slide valves. We do not know on what terms these can be obtained, but we should certainly advise anyone dealing with engines to find out more about it.

PERSONAL.

Mr. Harry H. Broderick has been appointed general foreman of the Boston & Albany at Springfield, Mass.

Mr. Edward H. Barnes has been appointed superintendent of the Raleigh & Western, with headquarters at Cumnock, N. C.

Mr. Chas. O. Johnson, formerly of Pacific Coast Railway, has been appointed superintendent of the Western Railway, of Guatemala.

Mr. B. Latimer, formerly train master on the Chicago, Burlington & Quincy, succeeds Mr. H. G. Hetzler as road master at Chicago, Ill.

Mr. James Paul, recently in charge of the air-brake repairs at the Savannah shops of the Plant System, has been appointed erecting foreman.

Our Western editorial representative, Mr. C. B. Conger, has got installed in room 934, Monadnock Block, Chicago, where he will be pleased to receive visits from friends.

Mr. Isaac Bromley has been appointed general advertising agent of the entire system of the New York, New Haven & Hartford, with offices at New Haven, Conn., and Boston, Mass.

Mr. J. G. McLaren has been appointed master mechanic of the Chicago & Erie, with headquarters at Huntington, Ind., vice Mr. Willard Kells, promoted. He was heretofore general foreman of the Chicago shops.

Mr. H. G. Hetzler, road master of the Chicago, Burlington & Quincy at Chicago, has been promoted to the position of superintendent of freight terminals at that place, vice Mr. F. A. Delano.

Mr. George H. Goodell has resigned as mechanical engineer of the Erie to accept a position with the Northern Pacific at St. Paul, Minn. He succeeds Mr. E. B. Thompson, resigned.

The jurisdiction of Mr. W. E. Symons, superintendent of motive power of the Plant system at Savannah, Ga., has been extended over the car department, and the master car builder will report to him.

Mr. L. H. Van Allen, in addition to his duties as superintendent of the Buffalo division of the Lehigh Valley, has assumed charge of the operations of the Lehigh Valley Transportation Company.

Mr. M. S. Curley, master mechanic of the Illinois Central at Water Valley, Miss., has been transferred to the Paducah shops, vice Mr. W. Hassman, resigned; headquarters at Paducah, Ky.

Mr. Frank Anthony, for the past two years gang foreman in the Burnside shops of the Illinois Central, has been appointed general foreman of the Savannah shops of the Plant system, vice Mr. W. T. Brewer, resigned.

Mr. John S. Thurman, mechanical engineer of the Missouri Pacific at St. Louis, Mo., has resigned. He will hereafter devote his time to several compressed air appliances which he has designed.

Mr. E. W. Grice has been appointed train master of the following divisions of the Chesapeake & Ohio Railway: Mountain District, Richmond; Allegheny District, James River; office at Clifton Forge, Va.

Mr. Malloy, formerly general superintendent of the Wyoming division of the Union Pacific, has been appointed superintendent of the Montana division of the Oregon Short Line; headquarters at Pocatello, Idaho.

Mr. T. F. Barton, master mechanic of the Illinois Central at East St. Louis, Ill., has been transferred to the Mississippi & Aberdeen divisions, with headquarters at Water Valley, Miss., vice Mr. M. S. Curley, transferred.

Mr. N. J. Pritchard has been appointed foreman of machinery on the Hutchinson & Southern Railway, with headquarters at Hutchinson, Kan. He was formerly general air-brake and steam-heat inspector on the Norfolk & Western Railway.

Mr. Thomas Reynolds, train master of the Cleveland, Cincinnati, Chicago & St. Louis at Riverside, Ohio, has been promoted to the position of superintendent of the Cairo division, vice Mr. William Quinn; headquarters at Mt. Carmel, Ill.

Mr. George Donahue, master mechanic of the Meadville division of the Erie, has been apointed assistant superintendent of motive power of the lines west of Salamanca, N. Y., with office at Cleveland, Ohio, vice Mr. Washington Lavery, transferred.

Mr. William Quinn, superintendent of the Cairo division of the Cleveland, Cincinnati, Chicago & St. Louis, has been transferred to the Cincinnati and Sandusky divisions of that system, with office at Springfield, Ohio, vice Mr. T. J. English, resigned.

Mr. J. R. Chambers, superintendent of motive power of the West Virginia Central & Pittsburgh Railway at Elkins, W. Va., has resigned to accept the position of master mechanic of the Buffalo division of the Lehigh Valley, with headquarters at Buffalo, N. Y.

Mr. C. Skinner has been appointed superintendent of motive power of the Toledo, St. Louis & Kansas City Railroad, with headquarters at Frankfort, Ind. Mr. Skinner was for several years master mechanic of the Alabama Great Southern at Birmingham, Ala.

Mr. Washington Lavery, assistant superintendent of motive power of the Western divisions of the Erie at Cleveland, Ohio, has been made assistant superintendent of motive power of the lines east of Salamanca, N. Y.; headquarters at New York City.

Mr. William E. Baker, superintendent of the Metropolitan West Side Elevated Railroad of Chicago, has resigned and been appointed general superintendent and chief electrical engineer of the Manhattan Elevated Railway Company of New York.

Mr. Willard Kells has been appointed master mechanic of the Meadville division of the Erie; headquarters at Meadville, Pa.; vice Mr. George Donahue, promoted. Mr. Kells was heretofore master mechanic of the Chicago & Erie at Huntington, Ind.

Mr. A. C. Beckwith has been appointed master mechanic of the St. Louis, Brooklyn, Eldorado and Carondelet districts of the St. Louis division of the Illinois Central, with headquarters at East St. Louis, Ill., vice Mr. T. F. Barton transferred.

Mr. John McGhie has taken charge of the advertising department of our Western territory, in place of Mr. Wakeman, resigned. Mr. McGhie goes to the West a stranger, and we bespeak for him the kind encouragement and warm reception for which our Western friends are noted.

Mr. R. O. Cumback, general foreman of the St. Joseph Terminal Railway Company, St. Joseph, Mo., has resigned to accept the position of superintendent of motive power of the West Virginia Central & Pittsburgh Railway, vice Mr. J. S. Chambers; headquarters at Elkins, W. Va.

Mr. F. W. Deibert has been appointed superintendent of motive power of the Buffalo, Rochester & Pittsburgh, in place of Mr. C. E. Turner, resigned. Mr. Deibert has been for several years master mechanic of the Chicago, Milwaukee & St. Paul, in charge of the Milwaukee shops.

The following appointments have been made on the Grand Trunk Railway: Mr. Robt. Patterson, master mechanic of shops at Stratford, Ont., vice Mr. J. D. Barnett, resigned, and Mr. J. E. Muhlfeld, master mechanic of Western division (headquarters at Fort Gratiot, Mich.), vice Mr. Robt. Patterson, transferred.

Mr. W. B. Steele, an engineer on the W. N. & P. division of the Boston & Maine, has been promoted to traveling engineer of the S. & W. M. & P. divisions of that road. He is only 6 feet 6 inches and weighs 250 pounds. He is doing good work, and is well liked by the men and officials.

The Cleveland Twist Drill Company, Cleveland, Ohio, announce that Mr. E. G. Buckwell has been engaged to take charge of their sales department. Mr. Buckwell's long experience as a traveling salesman, and later as a business manager, should greatly increase the efficiency of the company's office force. All orders and correspondence will be given prompt and intelligent attention.

Mr. J. W. Kendrick, general manager of the Northern Pacific, has been appointed second vice-president, and will continue in charge of the duties heretofore performed by him. Mr. Kendrick has been general manager since 1893, and has been with the Northern Pacific for the past twenty-five years.

Mr. F. A. Delano, heretofore superintendent of freight terminals of the Chicago, Burlington & Quincy at Chicago, Ill., has succeeded Mr. G. W. Rhodes as superintendent of motive power at Aurora, Ill. Mr. Delano is well qualified to assume his new duties, having served the company in various capacities from machinist apprentice up.

Mr. Godfrey W. Rhodes, for many years superintendent of motive power of the Chicago, Burlington & Quincy at Aurora, Ill., has resigned to accept the position of assistant general superintendent of the Burlington & Missouri River Railroad in Nebraska, with headquarters at Lincoln, Neb. His new duties will not estrange him from motive-power affairs, as he will continue to give much of his time to this department of his road.

The following changes have been made on the Chicago, Indianapolis & Louisville: Mr. W. P. Coburn has been appointed master mechanic, vice Mr. Henry Watkins, resigned; Mr. Chas. Coller has been appointed assistant master mechanic. All correspondence relating to the motive power department should be addressed to Mr. W. P. Coburn, master mechanic, La Fayette, Ind. All correspondence relating to the car department should be addressed to Mr. Chas. Coller, master car builder and assistant master mechanic.

The Boston Belting Company have withdrawn the agency for the sale of their goods from the Simmons Hardware Company, St. Louis, Mo., and have made arrangements with the Railway Supply Company, 11 North Sixth street, St. Louis, Mo., to represent them in a large portion of the territory formerly covered by representatives of the Simmons Hardware Company. The Railway Supply Company will carry a complete stock, and are in a position to fill orders promptly, at bottom factory prices.

Mr. James M. Wakeman, who has been the Western representative of LOCOMOTIVE ENGINEERING for two years, has left us to accept a better position on a combination of industrial papers controlled by Mr. J. H. McGraw, New York. We were exceedingly sorry to part with Mr. Wakeman, for he is a most successful business man, and one that nearly all advertisers were ready to welcome, whether they did business with him or not. We feel certain that there is a great business future ahead of Mr. Wakeman, and he thoroughly deserves whatever good fortune may come to him.

Mr. E. P. Mooney, for the past seven years connected with the Lehigh Valley Railroad as traveling engineer and master mechanic, and prior to that time for twenty-four years with the Lake Shore & Michigan Southern Railroad as locomotive and traveling engineer, has severed his railroad connections to take charge of the Buffalo office of the Chicago Pneumatic Tool Company. Mr. Mooney has a wide acquaintance among railroad men, and with his well-known push and energy will assuredly make a success in his new position, and still further increase the sales of the Chicago Pneumatic Tool Company in his territory.

When Mr. F. D. Underwood left Minneapolis to come to Baltimore to take the position of general manager of the Baltimore & Ohio Railroad he brought a straw hat and linen duster, says Mr. J. H. Maddy, expecting to bask in the balmy Southern breezes that blew up Chesapeake Bay sometimes. Within ten days after he took charge two hundred miles of the Baltimore & Ohio Railroad were blocked with snow, and Baltimore had a worse blizzard than anyone in the Northwest ever experienced. It cost the road about $60,000 a day for four days to get the tracks in condition to resume traffic, but the officials are very proud of the fact that they beat all competitors in getting trains through from Pittsburgh and other Western points to Baltimore, Philadelphia and New York. All of the through trains that were delayed by the storm were fortunately tied up at large towns, so that none of the passengers suffered from hunger or cold.

Mr. Robert S. Miller has been appointed assistant professor in charge of the Department of Machine Design, Purdue University, and Mr. L. V. Ludy has been made assistant in the Engineering Laboratory, assuming the work which has hitherto been carried by Mr. Miller. Mr. Miller is a graduate of the School of Electrical Engineering, class of '95, and received the degree of Mechanical Engineer from the same institution in 1897. Since graduating he has been assistant in the Engineering Laboratory, and later instructor in mechanical engineering. In addition to his routine work at Purdue, he had a leading part in the exhaustive series of tests made two years ago at Purdue upon the balanced compound locomotive, and last year was in immediate charge of the fuel tests made at the University for the Big Four road, and still more recently assisted in the duty test of the 20,000,000-gallon Snow pumping engine at Indianapolis, the results of which have attracted general attention.

Mr. W. H. Truesdale, general manager of the Chicago, Rock Island & Pacific, has been elected president of the Delaware, Lackawanna & Western Railroad in place of Mr. Samuel Sloan, retired. It is a very important rise in position, but there are few railroad officials better able than Mr. Truesdale to carry the important duties that will soon rest upon his shoulders. The Delaware, Lackawanna & Western is a great property, but it has not been managed with any width of policy, or with a view to do the best in developing its vast resources. The ancient policy of running each division to suit the ideas of the superintendent, and having rolling stock of different patterns on each division is still in vogue, and a very expensive practice it is. It is not to be supposed that a progressive president will permit practices of that kind to continue. Of late years the company have made good progress in abandoning ancient cars and locomotives, but they still have lots of scrap doing service that ought to have passed through the forge and melting pot years ago. Mr. Truesdale is not the man to interest himself in operating or mechanical details, but we greatly misjudge him if he does not promptly make it somebody's business to put the whole of the operating department on a modern basis. The operative officials of the road are good practical men, but they have not been encouraged to adopt progressive practices.

Three Men on The Engine.

There is a clique of politicians in Albany, N. Y., who are striving to pass a law compelling railroad companies running locomotives with the wide type of firebox, which requires the cab to be on the barrel of the boiler, to have two firemen, so that one can watch the engineer and note that he does not die or go to sleep. The bill is known as a "strike measure," a form of threatened legislation that is worked up to extract money or other favors from the pockets of corporations. If the railroad companies having engines with what trainmen call "Mother Hubbard" fireboxes would put speaking tubes or other means of communication between the engineer and fireman, it would be just as safe as if a third man were on, for he could not watch the engineer closely without being on the same side of the cab, and there is small enough room there now for one man.

Since the agitation for a third man on the engine was started, we have talked to a number of engineers and firemen on the subject, and most of them laughed at the idea. One engineer said, "Imagine how an engineer would feel all the time with the knowledge pressing upon him that a man at the other side of the cab was looking for him to die."

When any agitation like that for putting three men on the engine is started, the authors generally pretend that they are acting in the interests of labor, and try to catch votes on that pretense. We can assure the New York politicians that they will receive no thanks from enginemen by passing a law to add another man to the crew.

On freight trains there is generally a

head brakeman riding upon the engine, and he is often regarded as a nuisance. With the increase of air brakes, the head brakeman has little else to do than fill the fireman's seat. It is often difficult to get a head brakeman to take water and give the fireman liberty to attend to other duties. The engineer has no control over the head brakeman, because he belongs to a different department. We once nearly had a collision because a head brakeman refused to go forward to flag an approaching train until he got orders from the conductor. Unless engaged on work connected with the train, the head brakeman ought to be under the orders of the engineer, and part of his duty should be to take water, break coal and keep it within reach of the fireman.

Increasing Use of Pneumatic Tools.

There has been a noteworthy widening of the field of compressed air, and its use in tools is by no means a small part of it. Mr. J. W. Duntley, president of the Chicago Pneumatic Tool Company, reports a widely increasing business in foreign countries. Their London house has supplied complete plants in Belgium, France, Germany, Holland, Italy, Sweden, Russia, Egypt, Australia, India, Japan and South Africa. This is probably due in a measure to the repeated visits of Mr. Duntley to Europe, he having made six trips in the past three years.

He states that the early pneumatic tools used in Europe had such a decided vibration that workmen opposed their introduction, but that this has been overcome by the Boyer hammer. The Boyer piston drills are also said to have displaced the native rotary drills, owing to their economy of air and the amount of work they turn out.

Hand riveting has also received a fatal blow by the introduction of pneumatic riveters. In fact, the trial exhibition which Mr. Duntley made in Glasgow recently before a convention of shipbuilders, the quality of the work, the economy of air and the general good work of the tools so pleased them that they were adopted by many of the shipbuilders present.

Engineering, of London, examined the parts of some of their tools and spoke very highly of the workmanship they found, which accounts in a large measure for the success of any tool.

Mr. Duntley is pleased to be able to say that their tools are now found in all quarters of the globe, including Alaska and the Hawaiian Islands, which we may add is largely due to the enterprise displayed by Mr. Duntley and his associates.

The Baldwin Locomotive Works have more men employed in the drawing offices at present than they ever had before at one time.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(24) J. W. S., Live Oak, Fla., asks:

What is the best material to braze on end of tubes to make them fill the hole when hold has been rolled out of shape? A.—Copper.

(25) R. M. S., Atlanta, Ga., writes:

Do you think there is any likelihood of American railroads adopting copper for the construction of fireboxes? A.—None in the least.

(26) B. N. Y., Chicago, Ill., writes:

Do you think that an invention to make a locomotive burn oil or coal in the same firebox would pay much more than the Patent Office expenses? A.—There have been too many of that sort of inventions to make the chances of a new one a profitable enterprise.

(27) W. S. C., St. Augustine, Fla., asks:

After disconnecting is there any way to clamp valve stem with United States packing, or would a man have to remove steam chest cover and block valve? A.—All up-to-date engineers carry a cramp for holding valve stem, using metallic packing, for keeping it in position.

(28) J. M. T., St Joseph, Mo., writes:

We have some new boilers, about six or eight months' service, and bottom flues in center at back flue sheet are starting to leak. They show a drop or two of water and several beads of lime around end of flue. Do you think this is caused from mud? A.—Mud and scale, likely.

(29) J. W. A., Foster, Cal., writes:

Would firing with both dampers closed and swinging the door between each shovelful tend to cause leakage of flues? A.—Yes. The exhaust draws cold air exclusively through the door. When dampers are open the cold air is mixed with hot air passing through fire.

(30) J. M. T., St. Joseph, Mo., writes:

Will the system of firing by the single shovelful, as per December issue, work as well on switch engines doing heavy work? Won't working the lever down in corner tear the fire up too much in firing so light? I am not in a position to find out for myself. A.—It works just as well with switch engines. We saw many switch engines doing heavy work, and there was no smoke.

(31) R. J., McCook, Neb., writes:

1. Please explain the advantages piston valves have over the common balanced slide valve? A.—1. We do not know of any advantage the piston valve has over the balanced D-valve. 2. Are the piston valves set in the same way as slide valves? A.—2. Just in the same way, except that some of them take the steam inside the heads. When that is the case the setting is different.

(32) C. E. B., Erie, Pa., writes:

I have a stationary engineer friend who seems particularly well posted about valve motion, and he holds that the valve of a steam engine ought to have more lap on the back than on the front end to adjust the distorted action due to the angularity of the main rod. What do you say about this? A.—In a link motion engine the irregular cut-off due to the angularity of the main rod is corrected by hanging the link back of the center.

(33) Inquirer, Pittsburgh, writes:

I am familiar with the fact that small tubes in a locomotive boiler will provide more heating surface than large ones, but where is the safe average? We have engines with tubes ranging in diameter from 1¾ inches to 2¼ inches. Which size ought to be more efficient? A.—We think that 2 inches diameter of tube makes a good compromise. A smaller size is liable to choke with cinders and a larger size takes too much room and reduces the heating surface.

(34) Apprentice, Boston, writes:

I have been studying valve motion, and I find that the hanger stud of the link is placed behind the center. Now, I want to know what would happen if the stud was set ahead of the center. A.—What is known as the angularity of the main rod (which is explained in Sinclair's "Engine Running") tends to delay the cut-off during the backward stroke and to advance it during the forward stroke. Placing this hanger stud behind the center corrects this irregularity. Placing it ahead would make the irregularity worse.

(35) E. C. N., Eaton, O., asks:

1. Are extension fronts on some compound engines longer than necessary? A.—1. Not that we are aware of. 2. What was report of Master Mechanics' Association on steam and exhaust passages read at convention in 1894 in regard to front end? A.—2. It reads: "This test shows that an increase in the length of the smokebox over and above that necessary to get in a cinder pocket in front of the cylinder saddle is unnecessary and undesirable, as the long smokebox greatly decreases the vacuum. 3. Has nickel steel been used to any extent for staybolts? A.—3. We are not aware that it has been used for that purpose except in an experimental way.

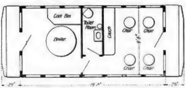
(36) R. M., Cleveland, O., writes:

It must be difficult for you to keep your question and answer column full every month, and I have thought of a plan that might be of mutual benefit to yourself, your readers and myself. I was for several years connected with a fireman's lodge which had a question box, and I made out most of the answers, so I am very familiar with the things railroad men want to know. Now for the modest sum of ten dollars a month I am willing to keep up a page monthly of questions and answers of the right sort. A.—Thanks awfully. The questions that come in for answer keep us on the frying pan one day every month, but we fear that ready-made

questions and answers would put us in the fire all the month.

(37) R. B., Indianapolis, Ind., writes:

We have a scientific apprentice in the shops who is fond of talking over the other boys, and he has had a great deal to say lately about the laws of motion. Can you tell an interested reader what these laws are? A.—The laws of motion were enunciated by the great astronomer Newton. The first one is: "Every body continues in its state of rest or of uniform motion in a straight line, except in so far as it may be compelled by impressed forces to change that state." The second law reads: "Change of motion is proportional to the impressed force, and takes place in the direction of the straight line



ERIE & WYOMING CAR AND ENGINE.

in which the force is impressed." These explanations do not make the case very clear, and it would take laborious writing on our part to do so. Those anxious to know more on the subject ought to study Goodeves' "Principles of Mechanics."

(38) J. B. K., Lima, O., writes:

In turning journals that have been in use, I have sometimes found one end materially smaller than the other end. Sometimes it would be the outside end that was smaller, and sometimes the inside end. The journals of tenders seem to wear more evenly than any other axle under the train. How can you account for this? A.—Various causes might bring about the uneven wear of journals. Some cars have a tendency to rest upon one side of the side bearings more than another, and that would have a tendency to throw the load unevenly upon the journal. Again it sometimes happens that men packing axle boxes will force too much packing towards the inside of the box, and a hard pad is formed which runs dry. That, of course, would increase the wear. On some cars the dust guards are very defective, and there is a constant stream of dust going in which strikes the inside part of the journal first. That will lead to the rapid wearing down of that part.

(39) H. C., Meadville, Pa., writes:

We have a number of Vauclain compound locomotives running here, and there is a good deal of discussion in relation to the starting of the by-pass valve. I would ask when the by-pass valve is open to start the train, if you take the steam out of one end of the high-pressure cylinder and put it into the exhaust end and thence through the exhaust to the steam side of the low-pressure piston? During this period of operation do we get the pressure against the high-pressure piston, and if we do, how much? A.—The statement is quite correct that when the by-pass valve is open the live steam passes from the active end to the exterior of the high-pressure cylinder and thence through the valve to the active end of the low-pressure cylinder. The admission line of the low-pressure cylinder corresponds with the back pressure of the high-pressure cylinder and the raising of this line increases the back pressure in the high-pressure cylinder. This difference, however, in the area between the two pistons causes an increase to the total effective pressure. This would be the case even if the initial and back pressure of the high-pressure cylinder were the same and the high-pressure cylinder worked in equilibrium. The effect, then, would be the same as with a single expansion locomotive using only low-pressure cylinder.

Erie & Wyoming Valley Inspection Car and Engine.

Our illustration shows a very neat and convenient inspection engine and car built by the Cooke Locomotive Works for the Erie & Wyoming Valley Railroad Company.

The engine is simple, with cylinders 8¼ x 8½ inches. The driving wheels are 42 inches diameter, and have Latrobe tires. The boiler, which is vertical, is 48 inches diameter, and contains 253 1¼-inch tubes. The pressure carried is 165 pounds per square inch. The tender has a capacity of 600 gallons. Plain steam brake is used, and the engine is supplied with equipment very much the same as those of greater size have. It has Richardson balanced valves, Lackawanna lubricators, Ashcroft gages and Nathan monitor injectors.

The car was made in accordance with plans furnished by Mr. George B. Smith, and is for his own personal use. It makes a very handsome, compact car, complete in all its appointments.

The Franklin Institute's Birthday.

On February 5th the Franklin Institute passed its seventy-fifth birthday, but did not celebrate it to any extent. The real celebration will be held in the fall, at the exposition which is to be held jointly by the Commercial Museum and the Franklin Institute. This is in line with their former work, and their expositions have been notable in many ways. Their Electrical Exhibition in 1884 was the pioneer in this line, bringing together for the first time the best machinery and apparatus. The stimulating effect of this exhibition has since borne abundant fruit.

The work of the Institute is not confined to Philadelphia, as many seem to think, but is almost world-wide, and the work of its Committee of Science and the Arts is known in railway fields as well as in other branches. The investigating of many devices which were found worthless have doubtless saved the mechanical public many thousands of dollars, by preventing them from purchasing or investing money in plausible schemes. The showing up of a recent counterbalancing

device for locomotives is a pertinent example of this.

The library of the Institute is, without doubt, the most valuable collection of mechanical books in America, and the privilege of consulting its volumes is not appreciated as it should be. It is to be regretted that financial conditions do not permit the erection of a new building more suitable to its needs, and we hope that a sufficient sum for this work may be raised in the near future. Although it seems old to most of us, we trust that at seventy-five it is just in the youth of its usefulness, and that it may give Methuselah points when it comes to longevity.

Steel Truck Combination.

The Schoen Pressed Steel Company, in conformity with the policy of enlargement and extension of their plant and interests, have purchased the Woods Run steel-making plant and mills of the Oliver-Snyder Steel Company, paying therefor the sum of $250,000, and will proceed to make the necessary changes and additions to the plant to alter it, entailing an additional expenditure of at least $100,000. This plan, as was stated in the *Post*, is forced upon the Schoen Company by the advent of the Carnegie Steel Company into the business of making pressed steel cars, and being the pioneer manufactory of steel cars, the company does not propose to be forced to the rear of the procession.

Something over three years ago, when the old Baltimore & Georges Creek sheet iron teakettle car was taken as a model and the first Schoen pressed steel car turned out, the company were said to be at a low ebb for business, and contemplating the reduction of the number of their employés and the changing of their manufacturing plant into a jobbing concern. The almost instant and phenomenal success of the first steel car made the Schoen Company famous the world over and gave them a line of business that has since magnified itself many times, until at present the works, rebuilt and enlarged many times, are far too small to accommodate the business of the company. Hence the recent reorganization of the company on a broader and more extended plan and the increase in facilities and enlargement of the plant. Then the Carnegie Steel Company appeared on the scene as a competitor, where it had been a customer, and in order to meet the sharp competition and still maintain the ordinary percentage of profits which the stockholders looked for, the Schoen Company were compelled to do away with a middleman profit and manufacture their own steel, which they had heretofore bought. The purchase of the Oliver-Snyder plant is the natural sequence of this policy, and within three months the Schoen Company will be the largest, or one of the largest, and best equipped companies in the world for the manufacture of their particular product.—*Pittsburgh Post.*

Railroading More Dangerous Than Soldiering.

A correspondent of the Chicago *Record* makes the following instructive comparison between the number of trainmen on the railways of the United States who were killed and injured during the last year and the number of soldiers who were killed, wounded or died of disease during the war: "During the year ended June 30, 1898, 162,873 trainmen were employed. Of these 1,073 were killed while in the performance of their duty and 15,936 were injured, which gives a percentage of 0.65 killed and 9.7 per cent. injured. The whole number of soldiers in the army did not at any time exceed 265,000. Of these 2,624 were killed or died of disease, which number was 0.99 per cent. of the whole, and 1,560 were wounded, which was 0.58 per cent. of the whole. In other words, one out of every 152 trainmen was killed and one out of every ten was injured, while in the army one soldier out of every 101 either was killed or died of disease, while one out of every 169 soldiers was wounded."

Steam Heating Instruction.

The intensely cold weather and storms during February have called attention to difficulties connected with heating passenger trains by steam. The usual remedy when the coaches get cold is to go to the engine and call for more steam back to the train, which the engine, on account of the extra amount used in handling the train, is sometimes in poor condition to furnish.

In such cases it is not unusual to have 60 pounds in the steam pipe under the train for direct steam-heated cars, when in ordinary weather, with everything in good order, 5 pounds is ample. Some of the trouble is caused by the pipes getting stopped up, so there is a poor circulation through them; others do not have fall enough so the condensed water will run out of the pipes to the drip valves; others may have the drips partially choked up or closed.

Much of this trouble is caused by a lack of correct knowledge on the part of trainmen. It is better not to know it all than to know it wrong. Some of them have had no previous experience. They can waste the heat in the cars by an improper use of the ventilators, which can take the heat out at the top as fast as the pipes can furnish it. The drips of a car get stopped up and the car gets cold; more steam is turned on, or the hand valves on the drips are opened, so that they steal the steam from the other cars.

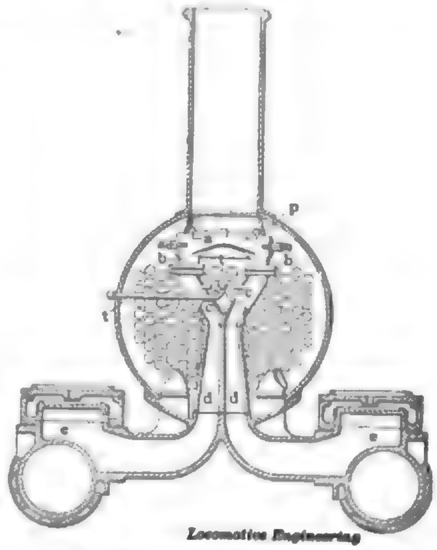
The various patentees or manufacturers of steam-heat equipment give a few directions what to do with their style of equipment, but they do not go into the details of what to do when anything gets out of order, as that would be a confession of defects. When anything goes wrong or is mismanaged in zero weather, the right move must be made at once.

If an instruction book on handling the various systems of steam heating of cars, similar to an air-brake instruction book, was in the market, it would find a ready sale.

A Smoke Consuming Device.

The device shown herewith has just been patented by Mr. John Y. Smith, whose triple-exhaust pipe attracted so much attention a few years ago.

This is an annular exhaust nozzle *a*, with two connections *b b* divided vertically by a serpentine wall and having a perforated top. One exhaust pipe connects to each side of this wall, so that exhausts



SMOKE CONSUMING DEVICE.

are separate, yet are equally divided all round the nozzle in alternate holes.

A ring blower is provided at *t* for producing draft and for diffusing and dissipating smoke when engine is standing. The action of the exhaust being diffused through the holes is said to reduce noise, dissipates smoke and "vacuum" produced in front, and reduces back pressure on the other side. This claim would seem to apply to any good exhaust, but the fine subdivision may enable a larger area to be used.

It is claimed that tests have proven these points, and that a spark-arrester is unnecessary where it is used.

The law of gravitation was well illustrated lately when watching the men cleaning the snow from the top of the huge arches of the Pennsylvania station in Jersey City. Lumps of all sizes would come crashing down, and the increase in speed or rate of fall could be distinctly seen. It was also noticeable that the different size lumps fell practically together, the difference in surface which met with air resistance as compared with the weight of the lump, easily accounting for any difference. It was simply a plain, everyday demonstration of a well-known law.

EQUIPMENT NOTES.

Murray, Dougal & Co. are building 500 cars for Delaware & Hudson Canal Company.

Missouri Car & Foundry Company have received an order for 250 cars from the Oregon Short Line.

The Manchester Locomotive Works are building four eight-wheel engines for the Fitchburg Railroad.

The Brooks Locomotive Works have received orders for ten consolidated locomotives for the Erie Railroad.

The Brooks Locomotive Works are building two consolidation locomotives for the Pittsburg, Bessemer & Lake Erie.

The Schenectady Locomotive Works are building two six-wheel connected engines for the Chicago & West Michigan.

The Brooks Locomotive Works are building two consolidated locomotives for the St. Joseph & Grand Island Railway.

The Chicago & Great Western are having ten six-wheel connected locomotives built at the Baldwin Locomotive Works.

The Baldwin Locomotive Works have received an order for ten consolidation engines from the Norfolk & Western Railway.

The Schenectady Locomotive Works are building three six-wheel connected engines for the Florence & Cripple Creek Railroad.

The Terre Haute & Indiana Railroad are having four six-wheel connected engines built by the Schenectady Locomotive Works.

The Duluth, Missabe & Northern Railway are having four six-wheel connected locomotives built at the Pittsburgh Locomotive Works.

The Richmond Locomotive Works are building two six-wheel connected locomotives for the Brainerd & Northern Minnesota Railway.

The Pullman Car Company are building 800 cars for the Chesapeake & Ohio, and 2,000 cars for the Cleveland, Cincinnati, Chicago & St. Louis.

The Dickson Locomotive Works have received orders for five consolidation locomotives for the Atchison, Topeka & Santa Fé Railway.

The Chicago, St. Paul, Minneapolis & Omaha have given an order for ten six-wheel connected locomotives to the Schenectady Locomotive Works.

The Michigan Peninsular Car Company have received orders for 500 cars for the Philadelphia & Reading, and 500 cars for the Chicago, Burlington & Quincy.

In writing on the grandeur of the new Boston Union Station, the *Transcript* says: "The Pharaohs who carved their names on vast and useless granite structures had to be content with less splendid memorials."

Using Exhaust Steam From the Air Pump.

A number of roads are experimenting on condensing the exhaust steam from the air pumps in a coil of pipe immersed in the water in the tenders. In one case about 65 feet of 1¼-inch pipe is used. No complaint is made that the water is heated hot enough so that the injectors will not pick it up, nor is any steam seen coming out at the outlet for the condensed water, which is through the bottom of the tank.

In another case, 165 feet of 1½-inch pipe is used, which is close to the bottom of the tank, so that it is always submerged. The water gets so hot long before it is half gone that the injectors will not pick it up. On one engine a donkey pump was attached for supplying the boiler, but that also failed to handle the hot water. These instances are from heavy switch engines with 9½-inch pumps, but in the case of road engines the results are the same.

LOCOMOTIVE ENGINEERING would be pleased to hear from any who have tried this plan, as to what the results are, how much pipe is used, etc.

New York Isolated by a Snow Storm.

The neighborhood of New York was last month visited by one of the worst snow storms ever known in that region. Heavy snowfall and high wind velocity acted together and proceeded to fill up all the cuts and sheltered places with deep beds of snow. Several of the railroads running into New York wrestled with the storm effects with their ancient inefficient ways, and when they found that Italian shovelers and push snow plows would not clear the track, they wilted like an Oriental fatalist, and practically said, "It is the will of God; we will wait till better weather comes," and all trains were abandoned. Travel was prostrated, thousands of people were prevented from getting to their homes or to business, because the managers of the railroads running into New York had not foresight or enterprise enough to provide themselves with modern machinery for the handling of snow. Several of the roads ran no trains for thirty hours; most of them ran their trains very irregularly for three days, and all that loss of revenue and delay would have been avoided had rotary snow plows been at hand to go out and clear the tracks. It is safe to say that some of the roads lost ten times the cost of a rotary snow plow, yet those responsible excuse their neglect on the score that a rotary plow is rarely necessary in the New York district.

That is no excuse for not being prepared. No better investment can be made than to have a rotary snow plow standing idle all winter, as many a Western railroad manager is willing to admit. Railroad managers are exceedingly touchy about legislators interfering with their business; but it seems to us that the big snow storm of February, 1899, caused so much unnecessary suffering and inconvenience to travelers near New York that legislators would be justified in insisting that provision should be made against a recurrence of the failure to keep trains running.

To Enable Passengers to Stop Trains.

The Northeastern Railway of England, we understand, have been making experiments with an appliance to enable passengers to apply the continuous brake to a train in case of emergency. The apparatus is worked by a lever in each compartment. This, when pushed up, releases the air in the Westinghouse brake pipe, and thus brings the brake into action, at the same time causing a whistle under the carriage to blow until the guard, by means of a key, restores the handle of the lever to its normal position. The guard is in this way able to locate the compartment. The appliance can also be used in connection with the automatic vacuum brake. A special train, fitted with the apparatus, was run from York to Scarborough and back, and the result was very successful. The train, which was traveling at speeds varying from 35 to 50 miles an hour, was stopped eleven times within a distance varying from 200 to 400 yards.

There is no great difficulty in devising an appliance that will enable a person in a compartment car to apply the brakes. The difficulty is to keep them from doing so at the wrong time.

Mysterious Behavior of Car Wheels.

In a newspaper cutting about railroad car wheels we find the following item, which is intended as a puzzler to be cogitated by the caboose fire and by the roundhouse bulletin board. It reads:

"But after this comes the question of the effects of polarity. A wheel running north and south will last longer than wheels running east and west. Physiologists and astronomers and men well versed in the science of magnetism and the effects of molecular motion have studied this problem, but they have not clearly defined or explained the phenomena which have caused the variations, but still the railway master mechanics and superintendents of motive power admit that the wheel running north and south will last much longer and make more miles than the wheel running east and west."

That question of molecular motion, magnetism and phenomenal mysteries attending the wear of car wheels we would explain on the same lines as we did the mystery of two locomotives that a correspondent said were built from the same templates and were different as the poles in their operation. One would run at the highest speed while pulling a heavy train, while no coaxing would make the other exceed twenty miles an hour. One day, about the same time, both engines acted like baulky horses. Nothing would make them go, although no defect could be dis-

covered about either. They were both hauled to headquarters, and all the experts within reach tried to diagnose the trouble, without success, and both engines had to be scrapped.

The molecular motion, etc., car wheel is a case of the same kind—too much imagination mixed with whisky.

Another story showing the kindness of Mr. James J. Hill, the railroad magnate, president of the Great Northern, toward his old employés has recently come to light. The story is to the effect that during the fatal illness of the veteran superintendent, Judson B. Rice, he expressed regret that his departure would leave his family in straitened circumstances. He had been incapacitated for some years from active railroad work, but President Hill had regularly kept his name on the payrolls of the company, and he had received each month a substantial check. Mr. Rice's one haunting thought in his last days was that this would cease with his death. A mutual friend of him and of Mr. Hill called to see the sick man one day, and to him Mr. Rice told his fears. This man went straightway to Mr. Hill and told him the situation. Mr. Hill promptly instructed him to assure Mr. Rice that his wife would be cared for, and shortly after the sick man passed away and was buried his widow received Mr. Hill's personal check for $10,000.

Brown & Sharpe Manufacturing Company, of Providence, R. I., have issued a new catalog, which contains 445 pages. It contains illustrations of the great part of the tools made by the company, and has a vast amount of information relating to the use of tools and the working of metals. One part is devoted to machine tools and the other to small tools; the latter we consider will be found particularly valuable for the information of workmen. Besides the information about tools, there is a great deal said concerning measurements. Tables are given of decimal equivalents of the inch, and also of millimeters and fractions of millimeters. There are numerous illustrations of micrometer calipers and information about how to use them. Every machinist interested in his business will find that this catalog constitutes a whole compendium of valuable information.

Judge Adams in the Circuit Court has handed down an opinion in the suit of McConway & Torley against the Shickle, Harrison & Howard Iron Company. The plaintiffs alleged that the St. Louis company infringed their patent on the Jenny freight car couplers, on which the complainants claim a patent granted February 21, 1882. The judge ruled that the complainants had a clear patent and that it had been infringed. The cases were referred to Judge James A. Seddon for an accounting of damages sustained by the complainants.

The Acme Machinery Company, of Cleveland, O., have issued a very artistic catalog showing some of the principal machines made by the company, among them being bolt cutters, nut tappers, bolt headers, forging machines, etc. The cuts illustrating the catalog are unusually well made, most of them being wood engravings, and are worthy of the high quality of the machines illustrated. Besides illustrations of machines, there are published a great many particulars about them which will be found very useful to shop foremen and others.

Messrs. Stannard & White, of Appleton, Wis., have begun to handle a new spring drop seat which bids fair to become very popular with enginemen (see advertisement in January number), as it will work on any engine and is quickly adjusted to any weight and operates with the greatest ease and simplicity. The "Weslland Drop Seat," as it is called, has a back-rest placed so it moves with the seat. The seat virtually hangs in spiral springs, with non-friction balls working in chilled grooves, thus taking off all friction, giving the engineer a smooth ride while the engine may jolt as it pleases.

During the month of February we received more letters for our correspondence department than were ever before received in two months. As we cannot fill the whole paper with letters we have been compelled to hold a great many of them over. The writers will need to possess their souls in patience until we find room for their letters.

It is reported that the Schoen Pressed Steel Company, of Pittsburgh, Pa., have made arrangements to erect a steel making plant, where all the steel used in constructing their cars will be made from the ore.

The Nicholson File Company, of Providence, R. I., recently published a little book called "File Filosophy," which they are prepared to send free to anyone who applies for it. It gives so much valuable information about the files that every man using a file ought to have it in his pocket.

The Chicago, Milwaukee & St. Paul mechanical department have been keeping careful records to show the relative consumption of fuel by simple and compound locomotives of similar capacity, doing the same work. On the East La Crosse division the saving in favor of the compound averaged 16 per cent. for a year. On the West La Crosse division the saving in favor of the compound was 19 per cent. The conditions of operating were practically even. All the compounds were of the Vauclain type.

Heavy British Express Engines.

The move that Mr. John F. McIntosh, of the Caledonian Railway, made in designing locomotives powerful enough to haul a heavy express train without assistance, has put other motive officials in Great Britain upon their metal to do likewise.

Among the improved designs resulting from this movement are two engines under construction at the North Eastern Railway shops at Gateshead designed by Mr. Wilson Worsdell. In the new engines Mr. Wilson Worsdell is departing from the usual system of four 7-foot wheels coupled, and starting another system of six 6-foot wheels coupled (with wheels 6 feet 1½ inches in diameter), with a four-wheeled truck in front. The new engines, of which two are being built at present for trial, will have outside cylinders 20 inches in diameter by 26 inches stroke, and a large boiler 5 feet in diameter in the barrel, with a firebox 8 feet long. The boiler will be provided with 204 2-inch copper tubes, and the working pressure will be 200 pounds. As the express trains of the future on the East Coast route will be much heavier than at present, these engines have been designed by Mr. Worsdell to work these heavy trains at express speed with only one engine instead of two, as hitherto. It is hoped and anticipated that the two new engines will be out by the end of June, and if they answer expectations the North Eastern Railway Company will build more of them. When constructed, the new locomotives will be the largest and heaviest in Great Britain.

Chicago & West Michigan Doings.

The Chicago & Western Michigan Railway is getting two ten-wheel engines from the Schenectady works, and the Detroit, Grand Rapids & Western Railroad two of the same type from the Manchester works.

These engines will have extended wagon top boilers with radial stays, built for a working pressure of 180 pounds. The cylinders are 18 x 24 inches, wheel centers 50 inches, and the engine weighs about 111,000 pounds. They will be used in fast service.

In addition to the new engines above mentioned, Mr. Haskell, superintendent of motive power, is having built over at the company's shops four engines for light passenger service. New boilers with generous heating service to carry 180 pounds of steam, built by the Schenectady works, are used; new frames supplied, and 16 x 24-inch cylinders. The engines formerly doing this work carried only 140 pounds, with restricted heating surface, and the use of larger boilers is a move in the right direction. The additional weight of the large boilers will give additional adhesion for the extra 40 pounds of steam used. While being very free steamers, good work can be got out of the engines.

The recent order of the Baltimore & Ohio Railroad for 5,000 steel coal cars, to be built by the Pressed Steel Company and the Carnegie Company, brings the total purchases of the receivers of the Baltimore & Ohio Railroad up to 30,394 since March 1, 1896. The locomotive purchases during that time have been 216, of which twenty are still to be delivered. The company has also purchased five postal cars, ten express cars, ten combination cars and six dining cars.

Rotary ploughs are great institutions in their place; but their place isn't in the narrow streets of a crowded city. The management of the Union Traction Company ran one up Eighth street, Philadelphia, recently, and hasn't got through settling damage claims yet. A stream of snow, ice and brick-bats made the acquaintance of the windows on one side of the street, and new windows are in order.

Chief Engineer W. T. Manning, of the Baltimore & Ohio Railroad, has invented a new rail that experts say has many points of interest to railroad owners, the principal one being its economical feature. It is well known that rails wear rapidly on curves, and where these are short and traffic heavy the cost of renewal is very large. Manning has evolved a section, which, he asserts, will reduce the cost 37 per cent. per year. He adds materially to the life of the rail by placing additional metal in the head and on the side upon which the wear comes. The new rail will be given a thorough test on the Baltimore & Ohio Railroad, the receivers having ordered 1,000 tons from the Carnegie Steel Company. The Pittsburgh & Western have also ordered 500 tons.

The Southwest system of the Pennsylvania Railroad does not provide side curtains for locomotives and there has been much suffering among the firemen during the excessively cold weather. If the officials responsible for depriving the enginemen of the comfort of having the biting wind shut off by curtains had to ride on the engines during stormy weather they would be a little more considerate for the men who have to ride in an exposed cab all the time. The men are agitating in favor of curtains and the first thing the company will hear about will be the enactment of laws making the providing of them compulsory.

Division superintendents of the Santa Fé are investigating pocket electric lights with storage battery, the chief value being in examining dark places where it is impracticable or impossible to get a coal oil lamp. For examining trucks, etc., in wrecks after dark, this light will be of very great service.

Fast Burlington Train.

The Burlington Fast Mail is a speedy train. It leaves Chicago at 9 P. M. daily, passes Western avenue, 3.8 miles out at 9.39, runs slow for a mile at Aurora, and is due at Mendota, 79 miles further out, at 10.55 P. M., or 79 miles in 76 minutes. The trip has been made to Burlington, 206 miles, in 179 minutes running time. The card time was regularly made during the late severe weather.

On the night of February 17th, this train left Chicago at 10.47, being detained by Eastern connections, and arrived at Omaha at 8.01 A. M.; 506 miles in 9 hours and 14 minutes. The actual running time is said to have been 8 hours and 44 minutes, or 506 miles in 524 minutes. Part of the way the speed was over 100 miles an hour. This was a very heavy train and was drawn by a Class "H" engine, 19 x 26-inch cylinders, carrying 180 pounds of steam. This is showing Uncle Sam what American railroads can do to hurry up the delivery of his mails.

After the Westinghouse air-brake instruction car had been teaching the trainmen of the Delaware, Lackawanna & Western how to handle brakes so that passengers would not be shaken up every time a stop was made, there was a little improvement perceptible, but nearly all the engineers have fallen back into their old, careless ways. We warn these men, who ought to be discharged for wilful inefficiency, that a new power will be over them directly, a power that has no hesitancy in giving careless enginemen what they deserve.

There is a movement going on at Dunsmore, Pa., to organize a class for the instruction of air-brake matters. In connection with that they expect to have the usual apparatus necessary for illustrating the action of air brakes, and also a library and reading room. The movement is carried on by men belonging to the Erie & Wyoming Valley Railroad, and the officials are giving the movement their warmest support.

The American School of Correspondence, Boston, Mass., offers special advantages to engineers and mechanics desiring to pass government examinations. Its object is to give them a thorough technical training in steam, electrical or mechanical engineering. The instruction is carefully graded, thoroughly practical and scientific, and is supervised by experts who are in close touch with the developments of the age. All instructors in the school are graduates of the leading technical schools, while the Advisory Board is composed of such well-known men as Dr. Robert Grimshaw, Charles Thom, Francis H. Boyer and others. The school is chartered by the Commonwealth of Massachusetts and is warmly endorsed by the leading educators and engineers throughout the country. It is strictly an educational institution, founded for the "advancement of the American mechanic," and the tuition fee is therefore placed within the reach of all wage-earners. Their handbook is of interest to all in this line of work.

The Central Railroad of New Jersey have decided to abandon the use of "Jimmeys," as their four-wheel coal cars are called, and replace them with 40-ton cars. Mr. C. H. Warren, assistant to President Maxwell, figures that the use of 40-ton cars in the place of the small ones will save 150,000 feet of side-track room; and that 62,500 loads of the big cars will equal 400,000 loads of the small ones. The dead weight hauled will be very much reduced.

Superintendent W. J. Murphy of the Queen & Crescent, has introduced a peculiar feature in railroading as a means of instructing trainmen. He had trains and signals photographed and uses these in magic lantern slides to illustrate a great many matters connected with the operating of the trains. Candidates for promotion are examined by the aid of these pictures.

The Ajax Manufacturing Company, of Cleveland, Ohio, send us a large sheet giving the names of parties using their machines. The list comprises car, locomotive and bridge builders, railroads, navy yards, and many other users of their forging machinery. The center illustrates the machines and shows old Vulcan startled by the work being turned out by one of the forging machines.

The combined committee of the American Railway Master Mechanics' and Master Car Builders' Associations have decided that the next convention, beginning on June 19th, will be held at Old Point Comfort. The headquarters will be at the Hotel Chamberlain. The Hygeia Hotel will also be opened for guests. The prices at both hotels varies from $3 to $5 for each person. Members of the associations will have the preference for rooms up till March 15th.

The Detroit Sheet Metal and Brass Works, Detroit, Mich., have sent us a copy of their catalog, showing their line of lubricators and oil cups. The McCoy locomotive lubricator seems to have several good points of its own.

The fact that circumstances alter cases very materially is too often overlooked by enthusiastic advocates of some new device, and they try to apply it to everything in sight, regardless of the conditions to be met. This has killed many a device which was good in its particular place.

Railroading in China.

According to the Tientsin correspondent of a London paper, a railway engineer's life in China is a very exciting one. He says: Besides natural and routine difficulties to be met with in all countries, he has to cope with mandarin intrigues, village opposition, mutinous railway coolies, turbulent soldiery, and, besides professional skill, he therefore needs in some measure the qualities of a diplomatist, soldier, linguist and philosopher.

Mr. Cox, who was recently assaulted near Pekin, has had many similar experiences during the dozen years he has been railroad building in the Chihli province; and he has only extricated himself by dint of tact, pluck and good humor. He has practically for years carried his life in his hand.

In 1890, for instance, during floods, a mob, led by the soldiery of Lutai, a military camp near Tientsin, cut the railway embankment and destroyed seven miles of line, their officers encouraging them, and the enlightened Viceroy, Li Hung Chang, in his Yamen a few miles off, "layin' low and sayin' nuffin." The cause alleged was that the embankment prevented the flood water from running off, which, as there were frequent outlets, was utter nonsense. Previous to that, attempts had been made to wreck trains; and the lives of the foreign employés were constantly threatened.

The life, too, of the foreign guard on a train is not always a happy one. Mandarins' servants without tickets take possession of a first-class carriage, eat, drink, sleep and perform other functions of nature in it. Perhaps they light a pan of charcoal to warm themselves if the weather is cold. Charcoal has certain asphyxiating effects; the other passengers complain, and the servants have to be ejected. Too much violence might lead to a general attack on foreigners and another Tientsin massacre; while too little would not be effective. The unhappy guard has to follow the "happy" mean between a good hard push and a mild knockdown blow.

There have, of course, been many ludicrous as well as dangerous incidents on the North China line. When it was first opened, Chinese would come to the booking office and try to bargain for tickets. When told the fare, they would offer half, and gradually raise their bid, much disgusted that they should not, in a business spirit, be met half way.

One day a country gentleman, on his first ride in a train, seeing his house midway between two stations flying past, deliberately opened the door and stepped out into space. At the pace the train was going a European would certainly have been killed; but the supple Celestial, after a prolonged series of somersaults, was seen to pick himself and bundle up, dust his clothes, and set off home across the fields—much pleased with his short-cut and the convenience of the "fire-wheel carriage."

An unfortunate railway coolie, equally ignorant of the laws of mechanics, did not get off so well. Seeing two trucks coming at a snail's pace down a siding, he placed his foot on the rail to stop them. To his astonishment it was cut off, and he learned, like Stephenson's cow, that momentum is made up of mass as well as velocity.

But, in spite of everything, railways are bound to prosper in a country where traveling is otherwise so slow and so difficult—carts and ponies in the north and boats in the south never doing more than thirty to forty miles between dawn and dark.

A new locomotive works is reported as being under way in Ottawa, Canada, backed by capital from both Ottawa and Toronto. The plant is said to be under way and the machinery is being built for it. It is also rumored that acetylene gas engines are to be built in the same works. Power is to be obtained from the Chaudiere Falls.

Mr. A. O. Norton, of Boston, Mass., manufacturer of power jacks, has issued a small illustrated catalog showing all the kinds of jacks he turns out and the prices for the same. There is a bewildering variety of them, but every one seems to have its own use. Those interested in the use of jacks ought to send for this convenient little pamphlet.

The New Jersey Car Spring & Rubber Company, of Jersey City, N. J., have issued a new catalog of rubber mats and mattings which they manufacture. The catalog is almost entirely given up to illustrations and descriptions, together with price lists, of mats and matting for a great variety of purposes, including stair treads, step treads and other varieties. It will be sent upon request.

The Ashton Valve Company, Boston, Mass., have issued a very neat calendar showing two happy youngsters, one with a little locomotive, the other a toy steamboat. It is called "Chips of the Old Block," and is very attractive and suggestive of the tendencies of the youngsters' paternal relative.

The Ingersoll-Sergeant Drill Company have just recently published their Catalog No. 41, which is gotten up in their usual artistic style. There are a great many illustrations of the drills at work, some of them being in quarries, others in tunnels, some high up in the air, and others under water. It is a very interesting pamphlet to look through, merely to let one know the immense variety of drilling operations the machines are applied to. It can be obtained from the Ingersoll-Sergeant Drill Company, Havemeyer Building, New York.

Railroads in Cuba.

A correspondent of a Chicago paper writes that there are many curious rules and practices in vogue on the railroads in Cuba. He said:

The Cuban Government regulations for the operations of railroads have this paragraph: 'The hand baggage of a gentleman shall consist of one hatbox, one satchel and one fighting chicken.' This being one of the rules for the government of the railroad properties of Cuba, it may be set down that there are others equally as foolish, and that the railroads are oppressed on senseless regulations. As a matter of practice the railroads will permit a man to carry 68 pounds of baggage, including the fighting chicken. This is a concession. One railroad 123 miles long has three first-class coaches, five second-class coaches and eight third-class coaches. They are in bad condition, and would not be acceptable to a second-rate road in the United States. This same road has eighty-five freight cars, including box, flat and coal cars. This road runs through one of the most populous districts of Cuba, and one of the most productive. The fare one way for a passenger is $7.40 in gold, a distance of 123 miles, as stated. Added to this is a Government tax of 10 per cent. and a small fixed tax which the railroad collects from the passenger for the Government. The total fare for the distance is a few cents less than $9. The tariff on a ton of first-class freight for the same distance is $22. A Government tax must also be collected from the shipper. The railroads are all in the hands of private corporations, but the Government exercises considerable control. The high prices for shipment and travel and the poor condition of the rolling stock and equipment form only a part of the troubles of the American military board trying to arrange for the transportation of troops. Lately there has been some consolidation of the different systems, but there remain fourteen different systems. The annoyance and vexation which this causes the shipper may best be explained by saying that in shipping a carload of freight from Havana to Cienfuegos four different railroads are used. Payments must be made separately to these different roads. Each one makes out its own bill of lading and incidentally pays its Government tax. Settlement must be made with each one of these roads. There is no system of prorating charges. The charges are so high that they are almost prohibitive, even for the United States Government.

The Houston & Texas Central Railroad Company is erecting new shops at Ennis, Texas; shops to be 92 x 170 feet, and to be equipped with the latest improved machinery, right up to date; shops and machinery to cost about $30,000.

We think the suggestion made in our Correspondence Department by Mr. E. W. Pratt, that LOCOMOTIVE ENGINEERING publish all the information relative to fuel and water economy that it can get from its readers, a good one. Send along your facts and we will gladly give them to the world at large. The mass of our readers form, as he says, a source of information much better than a committee selected by any organization.

We understand that the proprietors of the Rhode Island Locomotive Works are preparing to resume business. Mr. Joseph Lythgoe, the old superintendent, is looking for orders, and will again have charge of the works. They expect to begin building the ordinary steam locomotive. Much has been said about their building compressed-air motors, but they are not doing anything about that at present.

"Learn to Draw as an Accomplishment or for Self-Support" is the name of a small leaflet recently sent out by the International Correspondence Schools, of Scranton, Pa. Every youth who is ambitious to learn drawing and does not just know how to go about it should send for this little pamphlet. It will give him or her valuable information.

The Franklin Institute awarded the Elliott Cresson Gold Medal—the highest honor within the gift of the Institute—to Mr. Clemens Herschel, for the invention of the Venturi meter tube. Pamphlets describing the Venturi meter are mailed upon application to Builders Iron Foundry, Providence, R. I.

Compressed Air as a Motive Power.

Compressed air has been found so useful and economical in the transmission of power in railroad shops that nearly all industrial establishments where peripatetic tools are employed have followed the lead of railroad men and introduced compressed air for operating certain tools. This has led by degrees to a sort of sentiment in favor of compressed air, and its use has been commended out of all reason. For a great many shop operations, such as hoisting, riveting, drilling, chipping and driving small tools, compressed air is the best medium of transmission of power we know; it is also admirably adapted to tunneling operations, since it is constantly supplying fresh air in stifling places, but when we hear people raving about operating railroad trains by compressed air we conclude that the fool killer has been neglecting his business.

In their efforts to find something less objectionable than steam locomotives for operating their trains the Manhattan Elevated Railroad Company have repeatedly given the advocates of compressed air motors opportunities to show what they

could do. Their attempts to do the work of the small steam locomotives were laughably inefficient. For runs of a mile or two a compressed air motor may be more efficient than a horse, but the friends of that kind of motor had better be careful that they don't get too far from the teat of the air compressor.

We mentioned last month that a huge company has been formed in New York to boom what is called an autotruck, which is alleged to be capable of taking the place of the horse in the propulsion of street vehicles, from the light cab to the brewer's wagon. Compressed air was to be the motive power. The recent heavy snow storms have put a bad damper upon the motor carriage. Where that kind of vehicle was tried in the deep snow the wheels spun round but the vehicle remained stationary, and people who wanted to get home hired a team of horses to haul their motor and carriage to their destination. It will take a good deal of summer weather to bring the motor carriage to the popular position it held before the snow and slush overwhelmed us for many days.

Rules for Passengers on Turkish Railways.

Every passenger must be in his seat when the last gong sounds, a few moments before the departure of a train. Travelers buying tickets must present the exact amount of money to the ticket agent, otherwise he is authorized to charge a commission of 4 per cent for making change, which goes into his own pocket. Local tickets are good only for the train for which they are sold, and will not be redeemed, but through tickets will be accepted on all trains within the limit of time indicated upon them. Children under three years of age travel free, and between three and seven are carried at half rates. All gendarmes, prisoners of State, policemen and other officials are carried at half fare upon the presentation of a certificate of identity, called an "ilmihaber." Army officers and soldiers are carried for one-third fare upon the presentation of an "ilmihaber." Soldiers traveling on duty for the Government are carried free upon the presentation of a "pestie" certificate. Passengers found upon trains without tickets are required to pay three times the full fare between the place where they started and the first station reached after they are discovered, when they are allowed to buy a ticket for the rest of their journey at the regular rate.

One hundred pounds of baggage is allowed for every ticket, but the traveler has to pay 3 cents for having his trunk checked. The Oriental express and trains from Constantinople to Vienna (forty-four hours) and to Paris (seventy-two hours) run twice a week, and carry first-class parlor and sleeping cars. Similar trains run between Smyrna and Aden.

Trying to Make Power Out of Nothing.

When people discuss engineering problems together it is generally assumed that common-sense will at least influence their arguments. A writer to an English engineering paper did some riding lately on certain French locomotives, and he reported that, owing to large boiler capacity and other peculiarities, they could do better work in train hauling than any British locomotive in service.

A locomotive is very much like any other steam engine. If it has the advantage in boiler and cylinder capacity, it will leave others behind. It is therefore amusing to read the remarks of a correspondent of the *English Mechanic*, who says: "We have the best track, the best engines and the finest coaches. What more do we want? Whatever a French or an American engine can do, an English engine can do. Surely that is enough for an Englishman."

That is a peculiarly English way of looking at the subject. Owing to the narrow roadbed, low tunnels and bridges, no amount of ingenuity can make the boiler of an English locomotive have more than two-thirds the boiler capacity of an American locomotive. That is the misfortune of our transatlantic friends, and no blame attaches to them for it; but to say that on their particular soil and within the tribulations of their own sweet climate 666.6 pounds weighs more than 1,000 pounds, is putting the case outside rational engineering.

The capacity of a steam engine is no mystery. If you can keep up 10 pounds more mean effective pressure in a given size of cylinder than others of the same size are capable of maintaining, then the high pressure will develop the greater amount of power, be it to turn a steamer's propeller or the driving wheels of a locomotive.

Two of the passenger locomotives built by the Rogers Locomotive Works for the Eastern Minnesota Railway are equipped with the Wallace & Kellogg air-pump exhaust, feed-water heater and cylinder-lubricator attachment.

Gould & Eberhardt, of Newark, N. J., have sold the Eberhardt patent tool holder and all connected therewith to the Hugh Hill Tool Company, of Anderson, Ind.

The Falls Hollow Staybolt Company report business to be booming. They have just received an order for half a carload of staybolts to be shipped to the Pacific Coast. Every month orders are received from new customers for locomotive and train boilers.

The man who is afraid of doing more work than he is paid for is generally the man who hangs around the bottom of the ladder.

CONTENTS.

INDEX TO ADVERTISEMENTS.

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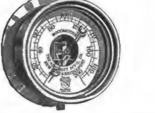

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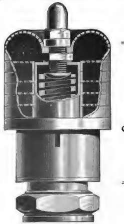

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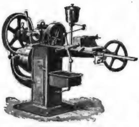

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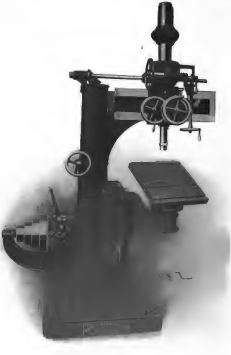

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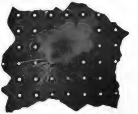

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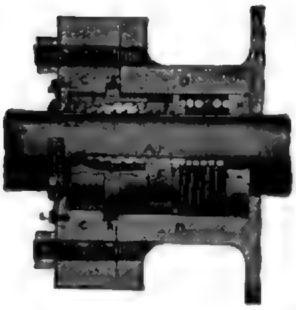

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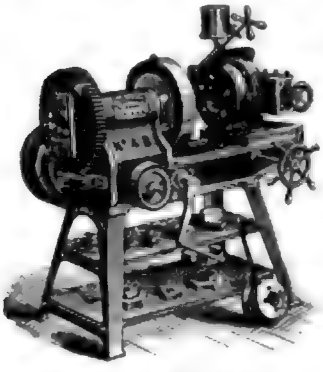

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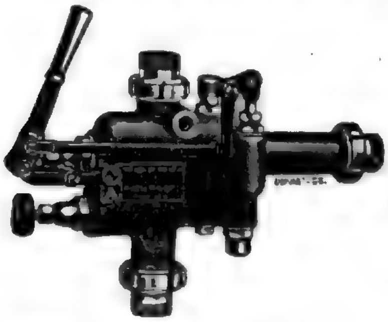

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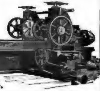

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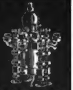

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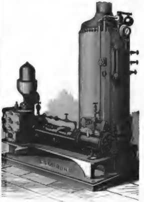

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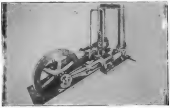

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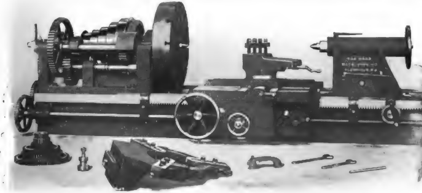

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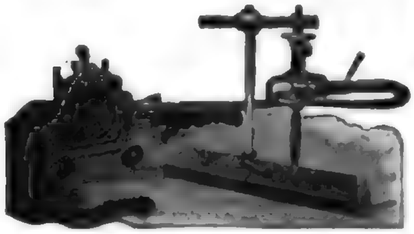

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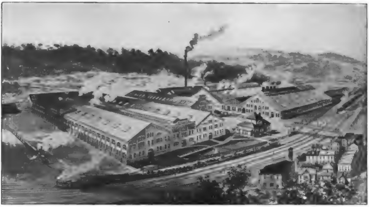

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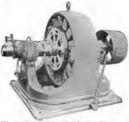

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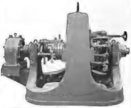

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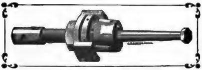

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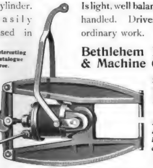

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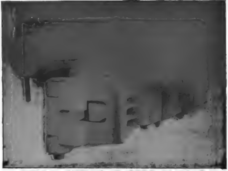

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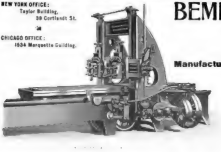

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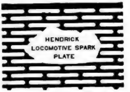

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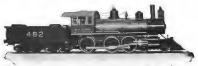

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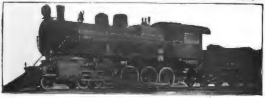

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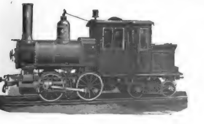

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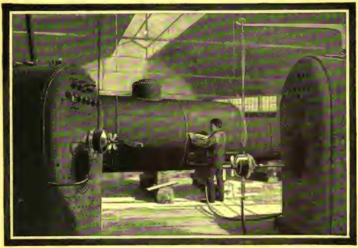

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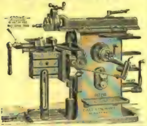

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Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

April, 1899
95 Liberty Street, New York
Price 20 Cents

The Miller Coupler.

THE accompanying drawing illustrates the National Miller Combination Passenger Coupler. Upper cut shows the National or M. C. B. type. Lower cut shows it in use with the Miller Knuckle. This Coupler has two especial advantages over anything else manufactured in this line. The change from one type to the other can be made in one minute, and for interchange service has no equal.

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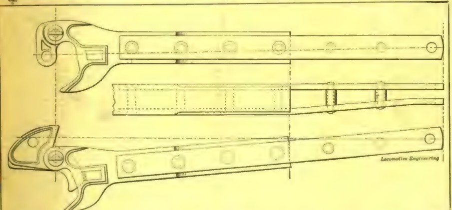

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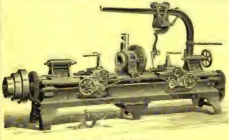
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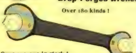

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Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

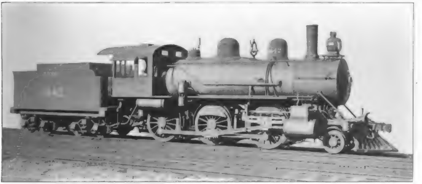
Vol. XII 95 Liberty Street, New York, April, 1899 No. 4

Southern Pacific Schenectady Mogul.

The handsome mogul locomotive shown on this page is one of twenty recently built by the Schenectady Locomotive Works for the Southern Pacific Company. The cylinders are 20 x 28 inches, the driving wheels 63 inches diameter, and the working boiler pressure is 190 pounds per square inch. The total weight of the engine in working order is 142,600 pounds, of which 123,700 is upon the driving wheels. From the figures quoted we calculate that the engine has close on 29,000 pounds tractive power, and that the ratio of adhesion is 4.3.

The valves are of the American-Allen type, have 6 inches travel and 1 inch outside lap with 1-32 inch inside lap. The ports are 18 inches long, the admission ports 1¾ and the exhaust port 3 inches wide. Jerome gland packing is used. Cast steel wheel centers are used for the driving wheels, and the engine truck wheels have Krupp cast-steel tires. The boiler is made of carbon steel, and is 62 inches diameter at smallest ring. Among the attachments specified are two monitor injectors, two encased consolidated safety valves, Westinghouse-American combined brakes on all drivers and tender, Sweeney brake attachment, Le Chatelier water brake and California couplers.

More particulars about the engine will be found in the diagram, page 172.



SOUTHERN PACIFIC SCHENECTADY MOGUL.

An Old Compound Engine.

While we are talking about compounds, the Missouri, Kansas & Texas Railway have a horizontal tandem compound engine that has been running steadily since about 1872, and is still as good as ever. The high-pressure cylinder, 14 x 30 inches, is next the crosshead, with one piston rod coupled between the guides. The low-pressure cylinder, 30 x 30 inches, is close to the high, and has two piston rods coupled to the crosshead outside the guides, passing along outside the high-pressure cylinder jacket and all. There is no intercepting valve to get out of order, the steam is distributed by a single plug valve in a chest on top of the high-pressure cylinder. This valve resembles a plug out of an angle cock, with a couple of flat places on the blind sides, in addition to the passage through it. It has a semi-rotative movement, there being no way of changing the cut-off, a governor regulates the steam supply. Only one of these valves has been replaced in all its twenty-seven years of service, driving the machinery of of the shops at Parsons, Kansas.

Counterbalance.

That the question of counterbalance is not a new one is shown by reference to old railroad literature. Both Braithewaite & Miller and Sharp & Roberts used balanced drivers in about 1837, the two firms seeming to work simultaneously.

In 1841 J. G. Bodmer patented a device for using two pistons to balance each other, similar to Shaw's scheme, also Strong's "perfect" engine of to-day.

In 1847 Heaton patented a device for a reciprocating weight, driven by reverse crank on the axle. This was to offset the other reciprocating parts, and was similar in design to Ericson's scheme some years later.

It was in 1845 when the balancing of both revolving and reciprocating parts by counter-weights in wheel began to be used, and this is the plan used to-day. There is, of course, quite a diversity of opinion as to the proper amount, but the idea is practically that of W. Fernihough, fifty-four years ago.

One of the latest idiocies in invention is the proposal to do away with car wheels and run cars on ball-bearing rollers. A long word effort of ridiculous rot has been published in support of the advantages to be derived from this invention, but we spare our readers the pain of perusing it. The foolishness has also been patented.

First Locomotive Built in New Jersey.

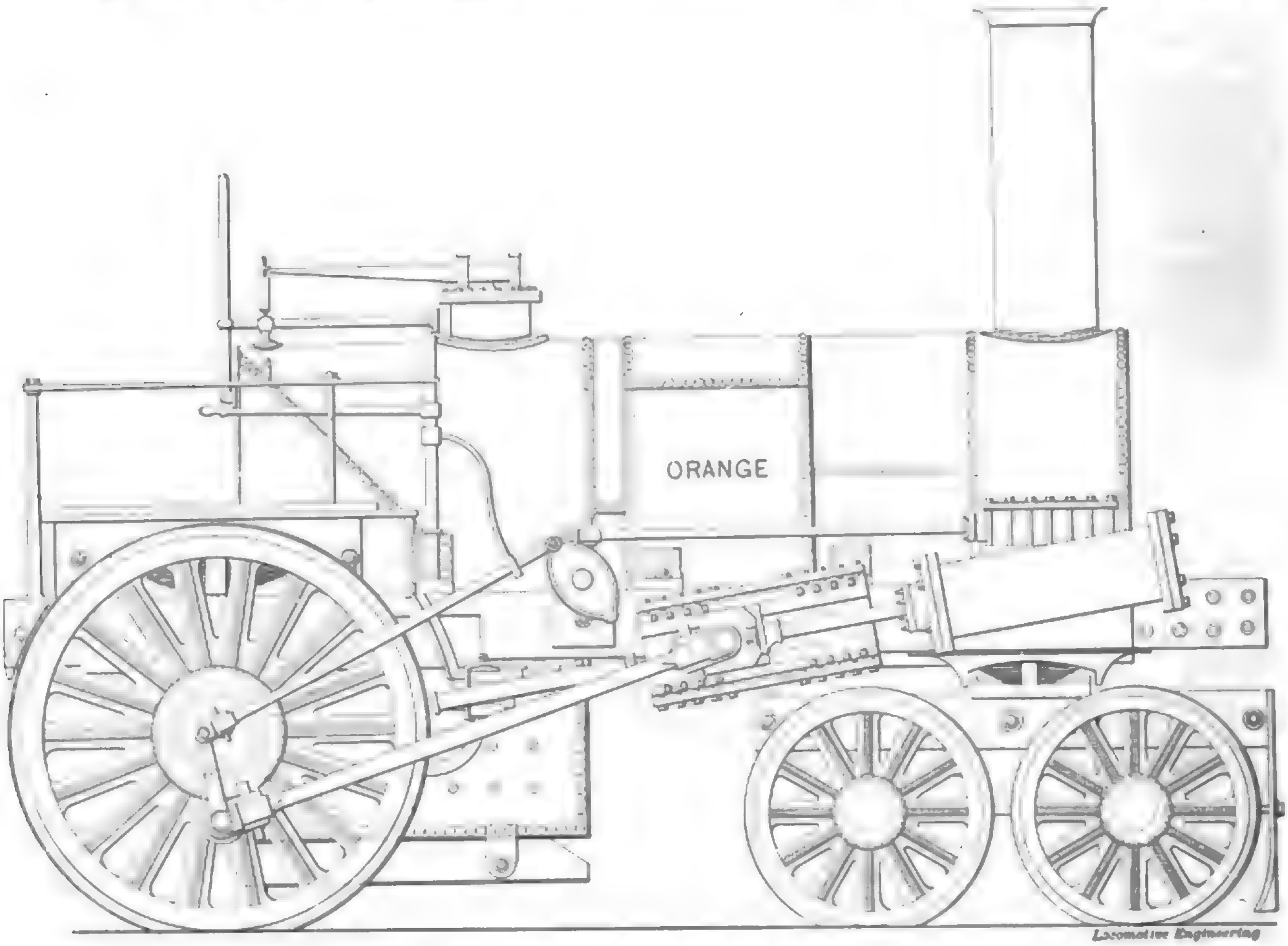
We are indebted to Mr. Andrew Reasoner, superintendent of the Delaware, Lackawanna & Western Railroad at Hoboken, for the blue-print from which the engraving of the old historical locomotive "Orange," hereby shown, was made.

The designs of this engine were prepared by P. I. Perrin in 1837, and the engine was built for the Morris & Essex Railroad by Seth Boyden, and was the first locomotive built in New Jersey.

The cylinders were 8¼ x 26 inches, the driving wheels were cast iron, flanged, with wooden spokes and were 53 inches diameter. The outside of the hubs, which was 18 inches diameter was highly polished, and the same practice was followed with the hubs of the truck wheels. The latter were 31 inches diameter.

This locomotive was placed on the road for trial August 1, 1837, and made its first trial passenger trip to Madison, September 13, 1837. The first regular passenger trip was made from Newark to Madison ten days later. We understand that the boiler pressure carried was about 100 pounds per square inch. It is interesting to make comparison between the power of this engine and that of some of the monsters that have been turned out within the last year.

We find that the traction force of the engine was about 2,600 pounds, which would enable it to start about 450 tons on a level track. The Carnegie consolidation engine shown in our November number would haul just about the same load as 22 engines of the "Orange" dimensions of engine would start.



FIRST LOCOMOTIVE BUILT IN NEW JERSEY.

Sources of Rubber Supply.

The total amount of rubber that was brought to the markets in the year ending June 30th last was 46,750 tons. Of this amount Brazil produced 24,750 tons, or a little more than half the entire supply. Africa's share was 19,800 tons, leaving only 2,200 tons to be supplied by the rest of the world. India furnished 495 tons and the balance of the supply, 1,705 tons, came from Central America and parts of South America outside of Brazil.

When the export of rubber from Brazil began about fifty years ago the quantity shipped in a year was only 495 tons. The British Minister in Brazil estimates that the area of rubber producing territory in Brazil that is still untouched amounts to 961,000 square miles, or nearly a third of the area of the United States, exclusive of Alaska. The great difficulty in developing these rubber regions is the scarcity of population and the consequent necessity of carrying food supplies everywhere. In all the vast rubber regions of Brazil it is estimated that there are only 140,000 inhabitants. The rubber districts that thus far have furnished the supply are becoming exhausted and the total production last year was less than in the preceding year.

In Africa there was until recently only one region which had been very conspicuous as a rubber producer. This was the Portugese colony of Angola, which in 1889 sent to the market 1,728 tons, while the Gold Coast and Lagos together furnished only 912 tons. In that year the Congo basin appeared in the market as a source of supply. Its progress since then has been rapid and in 1897 1,600 tons were exported from the upper Congo, though the rubber had to be carried a long distance on the heads of porters. The present prospects are that the Congo will some day be Brazil's nearest rival in the production of rubber

The Hawaii Islands have not much of a railroad mileage, but the men employed on the railways there seem to have a sound taste for engineering literature. LOCOMOTIVE ENGINEERING has thirty-one subscribers in these islands.

On a Brazilian Railroad.

Through the courtesy of Mr. G. E. Kennedy, superintendent of motive power of the road, we are able to present some interesting news of railroading in a sister republic. There are two gages in use, one is 2 feet 6 inches and the other the meter. The former runs from Sitio, a station on the Central Railroad of Brazil, to Paraopeba, where the Rio Paraopeba joins the Rio San Francisco, a distance of 602 kilometers (373¾ miles). There are also two branch lines, one of 34 (21 miles) and the other of 48 kilometers (29¾ miles). The last meets the meter gage at Riberao Vermeltro. There are 200 kilometers of the meter gage in use at present, but on account of the uncertainty in affairs, the intended construction from Angra dos Reis on the coast, through Barra Mausa, Riberao Vermetro (where the main shops are to be located), up to Catalav, is suspended. The company also has five flat bottom steamers and barges navigating the Rio Grande.

At present the principal shops are at Sao Joas del Rei, where the narrow gage (2 feet 6 inches) locomotives and cars are repaired, and cars for this gage are also built here. The meter engines stationed at Riberao Vermeltro and Barra Mausa are repaired at those places.

The small passenger engines, such as No. 12, have done good work, some of them being eighteen years old, and have a record of never having a tube give out yet. Must have pretty good water.

Mr. Kennedy writes that he has seen one of the consolidations, similar to No. 15, pull into Sao Joas del Rei with a 42-car train, weighing all told, 396,000 kilos (871,200 pounds). Not a bad train for a small engine. Engine No. 35 is shown, which was mentioned in our issue of September, 1898, on account of its remarkable performance of 152,089 kilometers (94,301 miles) in thirty-eight months of service and before going into the shop for repairs. Engine No. 12 ran over 80,000 kilometers (49,600 miles) between repairs, which is also a good record, considering the conditions of the road.

Box cars take a load of 10,000 kilos, (22,046 pounds), and cattle cars carry 12 head each, but the overhang of these cars makes cattle traffic decidedly risky on the narrower gage. A whole train has been known to fall on its side rounding a sharp curve.

The locomotives are all Baldwins, while the cars are from the Lancaster Company, of England, excepting a few made in Rio de Janeiro, and those constructed by the E. F. Oeste de Minas in their own shops. The water scene is one of the views along the line, being the Rio das Mortes (River of Deaths), between Sao Joas del Rei and Sitio.

THE RECORD BREAKER—E. F. OESTE DE MINAS, BRAZIL.

FALLS ON THE RIVER OF DEATHS—E. F. OESTE DE MINAS, BRAZIL.

Station Signals.

C. B. CONGER.

The improvement in these devices in the last few years, and immense numbers in use in comparison with ten years ago, is an indication of the value placed on their advantages.

So far the discussion of their merits, etc., has been limited to the signal engineers installing the apparatus, the superintendents who prescribe rules for their use and the inventors; while the locomotive engineer who governs the movements of the train by their indications has had little to say. A few words from his point of view may be of interest.

In the first place, all station signals, by which we mean order boards, switch targets and lights, and yard limit semaphores should be of a positive character; that is, they should show a certain standard shape of target and color of light for "Clear," and another shape of target and colored light for "Stop" or "Not clear." We will take up the matter of order boards first, as they are, or should be, at all telegraph offices. A very common form of order board has an oval target painted red with two white disks on it. In some cases instead of the white disks there are two round holes in the target, with the edges painted white, so that the position of the target can be more easily determined in daylight. This is in a measure a *negative* signal when set for "Clear" or "No orders," as the edge of the target is towards the approaching engineer. Variations of this style are legion in number; others show a white board or white light for "Clear," and a red board or light for "Stop."

A much better form is a blade similar to a semaphore, that is horizontal for "Stop" and depressed to an angle for "Clear." Such a blade can be seen from a considerable distance; and if striped with white, can be visible without regard to the color of the background. Although, as a principle, a moderately high signal has less chance of a poor background than a low one. It will also be visible over cars that may interpose between the engineer and the signal. A low signal that cannot be readily seen is the bane of the locomotive man. When the order board is located so low down that it cannot be seen over intervening box cars that may be standing between the office and passing trains, it is dangerous; for it is not

visible when passing it, so that the engineer must either get up out of his seat high enough to see over everything, or else depend on the head brakeman on top of the first box car to see it for him. In many cases this is the man of least railroad experience on the train. He is not responsible for passing order boards, and is not the man to depend on for information as to the position of signals.

Engineers are strongly in favor of having order boards located on the station building, high enough so that they can be seen from as great a distance as possible. If right above the office, they are easily located.

Against this high location, objection is made that the signal must be located so that the operator can see it, and thus be "Clear." For his convenience a pane of thick glass can be inserted in the top of the operator's bay window through which he can look up and see the signal. For night time a center-draft lamp with a circular wick would send light through the gas-pipe post on which the signal is located down on the operator's table in the office below. This would show a bright spot there when the lamp was burning. If it is assumed that the signal is for the operator's convenience, well and good; but we do not think so. It is to give a positive signal to the engineer, and nothing should come in the way of fulfilling that purpose.

As to the color of the light, red is generally used for "Stop." To this there is no dissent. A railroad man's education has taught him that red is a danger signal; and it always means "Stop," till you find out just what else it does mean.

For the "Clear" signal the Standard Train Rules prescribe white; so that an engineer must look for the location of a clear signal on an order board as well as its color. This among the various white signals around a depot, takes time and knowledge of all the white lights that may come in line with it. In case this light has gone out, and he mistakes another white light for the one that should be burning on the order board, there is a possibility of his running by the order board, as his attention may be called to something else when passing it. A green light can be more easily distinguished from other white lights close in range, as it will be the only light of that color set high up. Its welcome color shown to an engineman when in seeing distance of it will give him opportunity to look out for the lower signals and men on the ground.

CONSOLIDATION—E. F. OESTE DE MINAS, BRAZIL.

Switch targets are of so many various patterns on the same road that it is an endless job for an engineer to learn all their indications, while to the officers the task of reducing the many patterns to a standard system is no doubt perplexing. On one part of some roads we see one type of target; on another division another type without one point of similarity —even the colors vary from rusty iron to scarlet.

To make it easy and safe for the engineers, all the main-track switches should have the same type of targets, and be considerably higher than the targets on inside switches, so that an engineer running on the main track would not need to look for the low targets, and have time to look for the indications of all high ones.

The arrangement of targets should be with a view to giving him less to look out for that does not concern him; and the position of targets or signals not affecting the movements of his train certainly does not. The favorite target is a round, white disk showing its full shape to a man approaching it on that track for "Clear," with a fish-tailed blade on one side of the disk, painted a bright red, which will show its side when the switch is not set for "Clear" or turned for the siding. This will be a *positive* signal, indicating the position of the switch, with a different shape of target for each position, so that if the colors are dimmed by age or obscured by snow or sleet its form cannot be mistaken.

The argument is made that a main-line switch target should not show anything if the track is "Clear"—that is, the target should be edgeways towards the coming train. If this argument is true, of what use is a white light on this same switch at night? Yet you will find white lights used, giving a positive signal of the position of the switch.

SMALL PASSENGER ENGINE—E. F. OESTE DE MINAS, BRAZIL.

The lights of a main-track switch should be white and red, and for inside switches white and green. Then a main-line train

could run at speed whether lights showed white or green, while a single red light in its path would call for a stop.

Inside or yard switches away from the main track need a positive signal both day and night showing their position. They are used as much one way as another. If these targets are the same shape for one position as for the other, it takes a view of the location of the switch rails to settle which way it is set in fog or bad weather.

We talk of interlocking switch and railroad crossing signals with some difficdence, as signal engineers are struggling to establish uniformity. Some signals with two blades on the home post, one indicating a main-track route, the other a turn-out from the main line, have the top blade for the main track and the second one for the turn-out. At another point on the same road it may be that the top blade is for the right-hand track, whether a main-track route or turn-out. This is confusing. If the blade for the turn-out is shorter of the two, it helps out some, as its location on the post then cuts no figure.

Another matter which interferes with security is tne color of dwarf or pot signals that are located close to the main track. While these signals govern the movement of trains between the siding and the main track, yet when the main track is clear a red light is shown within a few feet of the main track, giving a clear signal with a red light, which must be located and made sure not to be a red light in a flagman's hand. Why cannot this color be changed to green or blue if you please, and set the signals outside the side track governed by it, and not between it and the main line?

Signal engineers may deny the importance of these matters and say that approved modern practice is nearer perfect, but the fact remains that when a certain type of targets and colors is installed they stay in service until worn out or broken up.

We take the ground that all signals of these classes mentioned are primarily for the guidance of moving trains, and they should be arranged for that end, and to put as little strain as possible on the engineer who sees them flash up before him and are gone in an instant. On the high-speed trains now run on all roads a man has to think quick when he sees anything wrong ahead of him. If all the signals are positive and arranged according to an easy system he will not have to study out in his mind whether a certain light is the one that affects his train or not, and give more attention to the other details of the work.

Do not overload the man at the throttle.

Compressed Air at Huntington Shop.

In addition to the use of compressed air for hoists, to handle the transfer tables, to open and close the iron safety shutters on the car shops, to pull cars in and out of the repair tracks of the car shops, the main engine of the Chesapeake & Ohio shop at Huntington has a shut-off valve in the steam pipe operated by an air-brake triple valve and auxiliary reservoir fastened to the engine frame and connected to a train pipe, which extends through the machine shop. At various suitable points, conductors' valves are placed, the handles of which are easily reached. Both the handles and a portion of the post near them are painted red, so as to be easily found.

If anyone gets fast in the machinery or shafting, or it is necessary to stop the main engine without waiting to go to the engine room, a pull on this valve operates the triple, shuts off steam at the engine and stops it at once. This device may be the means of saving someone's life or limbs if caught by a belt or shaft, and is creditable to the officers in charge.

At the same shop is a very convenient tool-carrier operated by compressed air, that carries small tools, such as cold chisels, etc., from distant parts of the shop to the tool grinder, who at once sends back a tool of the same kind ground ready for use. If the dull tool needs dressing, he sends it to the fire, from which it is returned to the grinder as soon as ready. Very large planer or cutting tools will not go in this pneumatic carrier, but have to be taken to the grinder by the mechanic. The contrast in loss of time waiting for small tools that go through the air carrier, and for large ones which have to be carried by hand, is very marked.

This pneumatic tube consists of 2-inch pipes with long, easy bends, extending upward and across the shop, where they will be out of the way of shafting, etc. The carrier is a piece of thin brass tubing, with a screw cap on one end which can be taken off to put in the tools. The other end is solid, and has a leather washer which fits the bore of the conduit pipe; so that when the valve at end of pipe is closed behind the carrier and air admitted, it is shot through to the other end, landing in a short pipe containing a spring; this with the air cushion formed in this short pipe stops the carrier easily.

There is no danger of a collision of the carriers in the tube, and the rush of air out of it is a warning not to try to use it when anything is coming towards you.

This tool carrier has been in use a long time, and gives perfect satisfaction.

PASSENGER CARS, FIRST AND SECOND CLASS—E. F. OESTE DE MINAS, BRAZIL.

An Air-Pump Kink.

When an air pump is sent out by train from the Lake Shore & Michigan Southern Railway shop at Elkhart to any outside point it has two wooden handles, like those on a wheel-barrow, bolted to it, which are about eighteen inches longer than the pump at each end. These handles are fastened to the pump brackets with bolts whose heads are flush with the surface of the handles, so a pump is easily slid into or out of a car door and it is moved around from place to place with very little trouble, as there is a good place to get hold of it, by four men if necessary. The handles come back on the pump that is returned, so they do not get lost or used for any other purpose. Anyone who has helped lift an air pump into a baggage car can appreciate this kink.

Running a Vauclain Compound.

BY C. G. HERMAN.

My experience with the Vauclain four-cylinder compound locomotive in regular train service on various railroads in this and other countries has taught me that the best method of handling this type of locomotive is as follows:

Let us consider the engine about to make a run with a heavy express passenger train, and that engine and train are all in proper order for starting. Then place the reverse lever in full forward position, move starting valve or cylinder cock lever in full forward position, i. e., position which opens the cylinder cocks and the starting valve, thus admitting live steam to the low-pressure cylinder, which will enable the engine to start quickly. Open the throttle, and after the engine has train to speed of about five to ten miles per hour and the cylinders are free from water, move the starting valve or cylinder-cock lever to the central position. In this position the cylinder cocks and starting valve are closed and engine is worked compound exclusively.

When engine has gained sufficient speed hook up the reverse lever a few notches, and continue to hook up the reverse lever as the engine gains in speed. In fact, this engine must be run using the reverse lever in the same manner as an engineer of good judgment uses it on a simple engine, except that longer cut-off is required on the compound. But the reverse lever must not be hooked up before the starting valve is placed in the central position. Many engineers persist in hooking up the engine before moving the starting valve to central position. They do so because they are accustomed to hook up a simple engine before closing the cylinder cocks.

If running on a level and the reverse lever has been moved up to the last notch —shortest cut-off—cutting off at half stroke of the high-pressure piston, and the engine still develops more power than is required, close the throttle partly, throttle down the power the same as is done on a simple engine. If running on a slightly descending grade, throttle the engine very close, allowing just sufficient steam to enter cylinders to keep the air valves closed which are placed in high-pressure exhaust port or low-pressure induction port. If the descent is such as not to allow the use of steam at all, then close the throttle, and after an interval of five seconds move the reverse lever half distance forward or down, and after another short interval it may be moved full forward or nearly so. In drifting on a descending grade move the starting-valve lever to full back position. This allows the air to circulate either way through the starting valve and pipe, which relieves the vacuum in cylinders and gives the engine the advantage of drifting freely. The cylinders are also better lubricated, the oil being distributed by this circulation of the air. With the starting-valve lever in this position when drifting, the Buchanan cylinder cocks being closed, allow air to enter cylinders but do not allow air to be discharged. If the cylinder cocks are open when drifting the air discharged through them also carries the oil out of the cylinders with it, and the cylinders are likely to become dry and cut. After having drifted to the foot of descending grade and a heavy ascending grade is met, over which it is necessary to continue the run at regular high speed, the first thing to do is to move the starting-valve lever in central position compounding, and hook up the reverse lever to half-stroke cut-off, i. e., shortest cut-off notch; next open throttle. If in ascending grade the engine slows down, move the reverse lever forward a notch and continue to drop the lever so as to keep up the momentum of the train, for it is more economical to compound the engine must be handled the same as on passenger if it is a fast freight. If it is a heavy, slow freight, the only difference of course would be that the train would be handled slowly on ascending grades, and it may be necessary on a few points of the run to put the starting lever full back position, using excess pressure a short distance to keep her from "laying down" at that place. This compound will haul a considerably heavier train at a slower speed than a simple engine will of same weight and power; that is, the simple engine will stall when it gets down to slow speed, while the compound may move still slower, but will continue moving on.

On ascending short, steep grades of few miles in length, it is advisable to make a run for it, as it will be found that in doing so the compound will keep speed

WHAT HAPPENED IN VIENNA, AUSTRIA, THROUGH OPEN SWITCH AND DEFECTIVE BRAKE.

keep up the speed than to lose it and then accelerate again.

Have the cylinder lubricator feed set so as to oil the same amount as is used on a single expansion engine of equal size and power. Compound engines of this type require no more cylinder oil than single expansion, and I know of cases where an oil record was made, proving that the compound could be run successfully with less oil than the simple engines on the same road.

If it is found necessary to open cylinder cocks when running at a high or low speed, owing to boiler priming or to having too much water in the boiler, the cylinder cocks can be opened without any detriment to the engine; as at high speed the steam will not pass through the starting valves quick enough to give an excessive pressure in low-pressure cylinder. Excess pressure is only had through starting valve to low-pressure cylinder at slow speed when starting.

To haul a heavy freight train with this thus gained for much longer run than a simple engine will of same power. To obtain the greatest economy with this engine, it should have an injector on right side of such a capacity as to enable the engineer to use it continuously, or at least continuously on ascending grades. By so doing, feeding water to boiler regularly, it gives firemen equal or regular conditions to fire engine against, and a good fireman will, under these conditions, fire very regularly, one shovelful at a time at regular intervals.

In regard to what should be done if any parts of the Vauclain compound become deranged or broken, I am compelled to say I have had little experience in break-downs on these compounds. I have ridden thousands of miles on them, but never had one of them to "fall down."

As compounds do break at times as well as simple engines, I will try to give some mode of fixing her up and to get her in when parts are broken.

This engine will haul a train when one

valve-stem is broken, and the break does not interfere with valve-stem packing, and I believe it will run with both valve-stems broken in same way. She will go all right after you get her started.

But this is possible only on engines that have a guide and crosshead to carry back end of valve stem, so that the broken ends of valve stem are kept in line. The proper motion is given to the valve by the greater pressure on front end. Owing to the valve stem in back end of valve, the area of that end is less by the area of valve stem than the front end of valve, hence the valve is always forced back by steam pressure and forced forward by broken valve stem. We do not use many of this style crosshead and guide back connection for valve stems at present.

To make the above possible, the valve stem or stems must have been broken outside of the valve-stem packing.

To have the same action with any other style valve stem, the broken ends of valve stem would have to be held in line.

If both high-pressure piston rods or heads were broken, remove the pistons, drive wooden plugs from inside into piston-rod holes, put up front cylinder heads, put starting valve in any position, and proceed with light train.

If high-pressure front cylinder head is broken on one side, disconnect valve stem from valve rod on that side, place the valve central position, covering the ports; keep the valve in that position by using the same style valve holder as is used on simple engines; i. e., a holder from gland studs to key slot in stem; disconnect main rod and block cross-head, and same as simple engines.

If one or both front high-pressure cylinder heads were broken, clamp wooden heads on, and proceed light.

If one or both low-pressure pistons were broken, remove pistons, drive wooden plugs inside in piston-rod holes in back heads, replace front cylinder heads, place starting-valve lever in compounding position, and proceed with light train.

If both low-pressure cylinders were broken, engine could be run in as above with high-pressure cylinders compounding position for starting valve.

Long Island Consolidation Engines.

The annexed half-tone engraving shows one of three consolidation engines, with wide fireboxes, recently built by the Brooks Locomotive Works for the Long Island Railroad.

BROOKS CONSOLIDATION FOR LONG ISLAND RAILROAD.

The engines weigh 155,000 pounds, of which 135,000 pounds are on the drivers. The total wheel base is 22 feet 9 inches, of which 14 feet 6 inches are rigid wheel base. The total length of the engine and tender is a trifle over 60 feet, and the center of the boiler is 8 feet 8 inches above the rails, while the smoke stack is 14 feet 3½ inches above the rail.

The total heating surface is 1,952 square feet, and the grate area is 69 square feet. Cast steel is used for the centers of drivers.

The cylinders are 21 x 28 inches. The driving wheels are 51 inches in diameter. This gives a tractive force of 37,000 pounds, and ratio of adhesion to tractive power is 3.6.

Richardson balanced valves are used, with a maximum travel of 6¼ inches; the outside lap is ¾ inch. The working steam pressure is 180 pounds. Other particulars of the engine will be found in our diagram on page 160.

Lost a Car out of Train Without Knowing It.

A press dispatch from Bloomington, Ill., about the middle of last month, says that railroad men here are marveling over a phenomenal occurrence on the Chicago & Alton last Wednesday night. A freight train was going west on the Kansas City division. When near Prentice, Ill., on account of a broken wheel, one of the cars was thrown from the track into the ditch, nearly fifteen feet from the rail. The track was not injured. The couplings at both ends of the car were automatic, and the car slipped out without breaking those on the two cars next to the derailed car. The two sections of the disunited train soon came together again and coupled automatically. The air connection was broken, but, although the train stopped and the air was again connected, the trainmen did not miss the car, and it was not missed until the conductor looked over his train at Roodhouse. The car was found in the ditch next morning by the roadmaster. Railway men here say the accident is the most phenomenal on record.

The Baldwin people are very busy, and will only accept orders on six months' delivery. They are turning out at present close on three engines a day, and have about 5,700 men employed; are trying to have as many men working nights as during the day. They have secured part of the property of the old Bushell Iron Works and are using the same as a foundry.

Amenities of a Modern Flood.

BY SAM SHORT.

There was a flood in the Ohio River valleys last month. It is by no means an uncommon thing for that particular river to take in more water than it can hold, but the inconveniences arising from that source never struck me so forcibly as they did this year. Perhaps that was because I had never seen the Ohio in flood before.

Well, when the stream was doing its best to rival the Genesis flood, I was in Cincinnati with the call for going out on the Baltimore & Ohio train about 8 o'clock. That seems a favorite time for people to rub the mud of Cincinnati off their shoes and depart.

When I got to the Union Depot there was a crowd of passengers there, and the cheering intelligence was given that the water was up over the tracks near the Union Depot and that 'busses would be provided to take the passengers to Eighth Street Station.

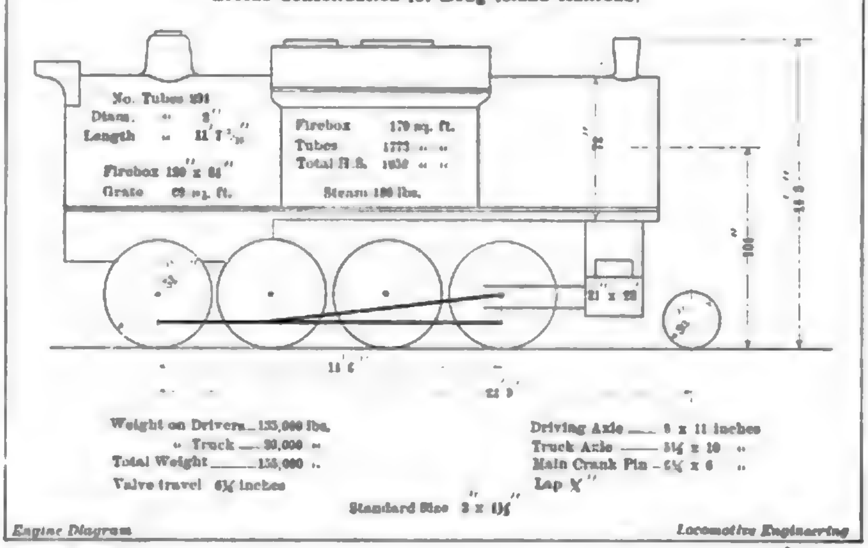
The men in charge of the 'busses were already in evidence. If any 'bus in Cincinnati was left out of this procession, Cincinnati must be well supplied with 'busses. There seemed to be a sufficient number of 'busses assigned to each train to carry the expected number of passengers. The men in charge seemed all anxious to attract all the passengers belonging to them, and a perfect Babel of shouting was in evidence. I stood on the sidewalk, intent on getting a B. & O. 'bus, and the shouts I heard were: "This way for the Big Four train," "This way for the Pan-Handle train," "This way for the C. & O. train," "This way for the B. & O. train," "This way for the Queen & Crescent train," "This way for the L. & N. train," and the good Lord alone knows how many other trains were called. The din was so confusing that you could not tell the direction from which the shouter of your train came. It was like a fog horn at sea—one time you would willingly swear it was on the port bow; next time you were equally certain that it was on the starboard quarter.

By great diligence and tact I found one of the B. & O. 'busses and entered. There was a miscellaneous crowd of men, women and children inside, half of them for the C. & O. (a mistake not to be wondered at, considering the tumult outside). The C. & O. goats were separated from the B. & O. sheep, not without some tongue friction; one lady goat of huge proportions having emphatically declared that she was told this was the C. & O. 'bus, and that she would hold to it if it took her to Chicago.

After much fussing our 'bus started. Just before the throttle of the horses was opened, a young man who seemed of the drummer persuasion jumped in, the door was banged and we were off. This young man could be heard making disparaging remarks about high water as the 'bus rattled through the stony streets. As soon as we arrived within hailing distance of the depot he jumped out and shouted "Where is that C. & O. train?"

I was following within hearing distance when I heard a uniformed man say: "The C. & O. train? Why those are the red lights of the C. & O. train. She pulled out just about a minute ago." Then the young man of drummer appearance fell loose. He jumped and stormed and swore as he jumped from one side of the street to the other, and he shouted loud enough to be heard in Kentucky, "Stop that C. & O. train. I am going to be married in Charleston to-morrow morning." Just as he made that interesting confession his feet slipped on a layer of ice under the mud and down he went on his back, his two satchels going in different directions and his hat taking its own course. Just then the B. & O. train came up, and as I climbed upon the sleeper platform I lingered to look at the bridegroom. Two men had helped him to his feet. One good Samaritan was scraping the mud from his clothes with a piece of hoop, and another was grooming his head with a handful of straw.

Brooks Consolidation for Long Island Railroad.



Lions Interfere With the Building of a Railroad in Africa.

Man-eating lions are delaying the progress of an important railway being built by the British in East Africa to connect Mombasa with Uganda. The voracious kings of the forest have developed a keen appetite for the Indian laborers, and have succeeded in decimating the working force from time to time since the enterprise got well under way. The lions did most of their foraging at night.

Now, it is learned, the quarters and houses of the laborers are protected by lion-proof stockades, which are 50 feet high and from 6 to 8 feet thick. Surrounded by these the men sleep in safety. One of the man-eaters who had dined on seventeen coolies on as many occasions came to grief finally when he attacked the men on a baggage car. They killed him and his skin is preserved as a souvenir to be sent to the British Museum.

A Water Brake.

We see that an engineer named Czvetkovich has invented a brake for steamships, by which collisions may be avoided. It is a large curved plate of steel to lower into the water and check the backward flow of water from the screws. A test of a 1,000-ton steamer, "Clotilde," brought it from a speed of ten knots to a standstill in thirty seconds, during which she *only traveled twenty feet after brake was applied*. Let's see about it.

Ten knots an hour is 1,029.6 feet per minute. Thirty seconds used to be half a minute; and in this time the ship would travel 514.8 feet. If she stops in 20 feet there is the force that would have taken her the remaining 494.8 feet to be taken care of. The effect on the passengers and the boat itself would be little less disastrous than a collision, and even if this could be done—which is hardly within the bounds of possibility—we think it will be some time before steamships wear steel bustles of this description.

We recently saw one of the big Delaware, Susquehanna & Schuylkill engines, designed by the late Daniel Coxe, easily handling a train of fifty-one large coal cars and an eight-wheel caboose up the Lehigh river through Easton, over the Lehigh Valley tracks. Every car was air-braked, and with the engine made a very business-like looking train. Of course the cars were empties, but as they weighed about 25,000 pounds each, it made quite a load in itself.

General Correspondence.

All letters in this Department must have name of author attached.

Railways and Locomotives in Denmark

As I believe it would be of interest to some of the readers of LOCOMOTIVE ENGINEERING to see how engines look in this part of the world, I send you herewith a picture of an engine belonging to the South Fyen Railway Company, Denmark.

This country, being only a small one and made up of islands, can necessarily only have very short railroads, and as the population is about the same as that of Greater New York, the traffic, of course, cannot be compared with that of the greater nations, and the trains and engines are in proportion to what is needed.

The engine shown on this picture is not of the largest in this country, but the general appearance is about the same, as every engine in Denmark (all but one) is designed by the superintendent of motive power of the State railways.

All the main lines of railroads are run by the government, but there are a great many smaller roads owned and run by private corporations; but they nearly all have to follow suit to what the State dictates. The one engine which is not a Dane is a small switching engine recently built by the Baldwin Locomotive Works, and belongs to the South Fyen Railway Company, in whose employ I am.

The engine of which I send you this picture may be called a typical Danish engine, and, as you see, it does not look American at all, except, perhaps, the arrangement of wheels; but the wide smokebox, the side buffers and the outside valve gear with the straight link give it a distinct German look. Nevertheless, it is a smart little engine, and does the service required; but it has rather too much cylinder for the size of boiler. I will give you here its leading dimensions:

Diameter of driving wheels—60 inches.
Wheel-base (total) of engine alone—19 feet 9 inches.
Diameter of cylinders—15 inches.
Stroke—22 inches.
Boiler pressure—150 pounds.
Number of flues—114.
Diameter of flues—1⅞ inches.
Heating surface of flues—523 square feet
Heating surface of firebox—74 square feet.
Heating surface, total—597 square feet.
Grate surface—13.5 square feet.
Weight on drivers—39,000 pounds.
Weight on truck—23,800 pounds.
Weight on engine—62,800 pounds.

The tank will hold 11,000 pounds of water and 2 tons of coal. The engine and tender weigh together 45 tons. The valves are not balanced.

J. C. MILLING.

Svendborg, Denmark.

TYPICAL DANISH LOCOMOTIVE.

Filling Boiler From Distant Water Supply.

"Engine 'L' is derailed out in the yard; has no water in her tank and a very scanty supply in her boiler. Presently it will be necessary to dump her fire. It will take five hundred feet of hose to get water from the nearest hydrant. Immediately notify the city fire department to come with their hose cart, etc." This is the character of a report that greeted the engine house authorities one bitterly cold night during the month of February when the thermometer was registering twenty odd degrees below zero, and to intensify the bitterness of the night a strong gale of wind was blowing briskly.

This is a hazardous predicament of affairs on a cold night and needs immediate and vigorous attention. The writer was acquainted of this accident and movements were made at once to protect the boiler and to avoid any additional damage to the engine.

Forty-five feet of rubber hose were placed on an engine, which will be styled "K" for convenience, and was hastened to the scene of accident. Engine "K" was placed on adjacent track. The hose of engine "L" was disconnected and the forty-five feet of rubber hose attached to the ingress pipe of engine "L's" injector. The other end of the hose was immersed in the water in engine "K's" tank, through the man-hole. Then engine "L's" injector was started and her boiler was soon filled. This not only made engine "L" safe, but also rendered her an efficient factor in retracking herself.

On a former occasion in dealing with an engine that got blocked in the yard during a severe snow storm, both of whose tank hose were allowed to freeze up solid and let the water get low in the boiler, her tank hose was disconnected from the ingress pipe to the right injector. This pipe was thawed out and the hose attached as above described, and the opposite end immersed in the water of her own tank through the man-hole.

In the former case the engine was equipped with a Metropolitan No. 10 injector, while the latter engine was equipped with a Monitor No. 9 injector; hence, reasoning by induction, it can be safely concluded that any lifting injector will perform similar feats. Care, however, must be taken to have the hose sufficiently rigid to prevent it from collapsing when the lifting jet is turned on, as under such circumstances an insufficient amount of water will flow through the hose to supply the injector, and, of course, your injector will work very imperfectly.

A few cases have come under the writer's observation where if such means were at hand at wrecks on the road, engines could be supplied with water, and thus avoid a great deal of unnecessary and disagreeable labor. The engines could also be utilized in rendering invaluable aid in getting themselves back on to the rails; hence, I would consider no

"wrecking outfit" complete unless it had at least fifty feet of 2-inch rubber hose to cope with exigencies.

JAMES FRANCIS.

Carbondale, Pa.

Cracking of Steel Tools.

The cracking of tools while being ground can hardly be the fault of the machine. There should be some data in connection with the complaint. There are two factors in the case—what kind of steel and what were the conditions under which the tool dresser did his part? Mushet steel should not be ground on a *wet* emery wheel. The heat imparted by a grindstone does very little, if any, damage to mushet tools.

You may be mistaken about the right grade of the emery wheel. For knocking the temper out of tools, commend me to a fine stone. It calls for the best care to prevent moving the temper, even while using water on a fine emery wheel. Yes, I use them every day.

In quoting rolled surfaces and knowing that valve rods are about as cranky a job as a man can put in the lathe, I would ask what support, if any, is used to resist the thrust of the rolling tool, also how wide on the face is the roller?

W. DE SANNO.

Vallejo, Cal.

The Air Pump and Hollow Shafts.

If I interpret Mr. De Sanno's letter in February LOCOMOTIVE ENGINEERING correctly, he would have his readers believe that an air pump does not pump air, and that a hollow shaft is not as strong as a solid one, all of which refers to marine work. Now, I am inclined to think he is mistaken in these respects.

In the manufacture of ice, air is one of the hardest things in the water to get rid of; the process now being to convert the water into steam, condense it, reboil it, then filter, and then take every precaution that it shall not have an opportunity to mix with the air till frozen. Of course, air is not visible in the water; but if it is frozen with the air in it, white ice is the result.

Numerous illustrations could be given, and especially so since the advent of the air brake, showing that air and water are naturally mixed to a greater or less extent.

Sea water, at atmospheric pressure and 60 degrees temperature, contains 5 per cent. of air, and when it gets into the condenser it will expand, say, fifteen times; hence $5 \times 15 = 75$ per cent., which shows that three-fourths of the capacity of the air pump will be required to keep the air pumped out of the condenser. The more waste, leaks and perfect the vacuum, the larger the air pump required.

Webster defines air pump as being "used to exhaust from a condenser the condensed steam, the water used for condensing, and the air that has come out of this water when warmed by the condensation of steam." A "dry" air pump is used in some kind of condensers for stationary engines. It seems to me that the men your correspondent mentions who "think that an air pump *does pump air*" are in the right.

In regard to the strength of engine shafts, the reader is referred to "The Evolution of the Modern Engine Shaft," by H. F. J. Porter, M. E., in *Power*, August, 1898. This article treats the subject fully, and shows that a hollow-forged oil tempered steel shaft is seven times stronger than a solid wrought-iron shaft of same weight and length. In other instances the strength of the shaft was lessened by boring a hole in it; but a steel shaft that is bored and afterwards oil tempered is one-fourth stronger than it was when solid. I am satisfied that shafts are made hollow to increase their strength, and I seriously question if they have any other advantage.

J. H. DUNBAR.

Youngstown, O.

Smoke Prevention on the Pacific Coast.

Reading the article on burning soft coal in December LOCOMOTIVE ENGINEERING, I was surprised that the management of the Burlington, Cedar Rapids & Northern were just learning at this late date that continuous firing, or, as they say, one-scoop firing, was the proper way to fire soft coal; also that Mr. Newsam, "a mine owner," could get on to an engine and instruct the fireman to make the great saving claimed in coal and smoke.

They certainly do not class with the fireman on the Pacific system of the Southern Pacific Company's road. Here that style of firing has been in everyday use for years.

In fact, we have passed the *one* scoop, and are now using a half scoop holding 8 pounds (most of the men only fill it half full). To assist this very style of firing, the company have placed a 6-inch baffler door on their engines. The door can be opened and closed or left open all the time while working steam. A fireman on this road never sits down when engine is working steam, but keeps the scoop going in a slow way most of the time, placing the coal just where it is wanted, and doing the placing with the scoop. Here engineers and firemen divide the honors of their results, also the blame; therefore engineers are as saving of the fire as the firemen.

We have been looking East for improvement; but in this line I am afraid they might look this way. Perhaps it is because they have been paying one dollar per ton for coal to our seven that keeps them so far behind the times in that line. If the firemen on this system do not fire in this way, it is not ignorance that makes them do otherwise, for they all know how.

C. R. PETRIE.

Los Angeles, Cal.

[We are gratified to learn about the fine firing they do on the Pacific Coast; but it is passing strange that officials belonging to the Southern Pacific went all the way to Cedar Rapids to study the system of firing described in our December number.—Ed.]

Discouragements.

Many a school boy has thrown up his books and lost the chance of an education for lack of encouragement. Many an engineer and firemen have "thrown up the sponge" after trying to be well up on the various performance sheets when they found their efforts unappreciated, apparently, and their good intentions meeting with little or no encouragement. Any man with pride likes to see his labors noticed by his employer, and this same lack of even passing notice puts a damper on many a high-strung man's ambition, and causes him to become careless, indifferent, and perhaps stupid.

An engineer who takes pride in keeping up his engine, in seeing that wedges are snug, rod brasses solid, pump and brake apparatus O K, nuts tightly packed, headlight clean, etc., will get "hot in the collar" when he proceeds to roundhouse and finds the valves he reported "squared" still occupying their usual position (which means an extra notch all over the division and at least an extra ton of coal), the driving brake cylinder packing holding brake on just while train pipe pressure is being reduced, and the tender brake with a travel that would make "Dusty Roads" tired. The lame engine means more coal and the poor brakes more oil, for instead of making all stops with the brakes Jim will have to "choke her," which same means more valve oil. As he climbs in the cab he discovers both gage cocks still weeping noisily and the top one stopped up, although these things have been several times reported; and the boiler head that his "side kicker" had spent a whole day in polishing, looks like a certain "eagle eye's" white shirt after it had been worn three weeks and incidentally used as a spittoon. Just as the blue smoke quits rolling through cab ventilator and our disgusted engineer gets down to oil around, the fire-boy shows up and again the ventilator emits blue smoke, as he sees his nice boiler head covered with spatterings from gage cocks and covered with smoke and ashes. The front end and stack that were so smooth with graphite that a "fly would slip and break his neck" are now decorated with a coat of unmentionable material, and two disgusted and discouraged men start out on local freight to make a coal record? "Oh, no!" Bill says, "That's the last time I'll

clean her up," and Jim says, "Yes, to h—l with her."

They couple the "888" on to their train, conductor hands Jim the orders and shows him a fistful of messages to pick up and set out cars at all spurs and sidings (which means three or four hours' switching with no credit for coal, brakes no good and she handles hard), and Jim's "hot collar" begins to smoke, but he pulls the slack out gently, and the three-cornered music begins. They only have a light train to start with, and if she was square could make fine time working in first notch, but she only has three exhausts cutting off at six inches, so Jim drops her a notch, and with a liberal dose of throttle they hop along at a twenty-mile gait when she should make twenty-five cut back in first notch. Our genial brakeman becomes uneasy as he observes Bill's spinal column with a continuous bow in it, which says plainly "coal up on the road," and remarks that "the '888' aint as good as she was awhile back," and tells Jim how "Skinny Walker used to make her climb a telegraph pole," by way of encouragement. Jim replies with a sad smile, as he wonders how far Skinny would get her up Beaver Hill now, let alone a telegraph pole. Their grief continues until end of month, when performance sheet is made up and our heroes find themselves just above "Daddy Pound 'em Hard," and second to the bottom of list.

This is no extreme case, but we have known and met in our travels with many such instances. Had these men had any encouragement from any one in authority over them they could have made at least a fair showing, even with the valves of the "888" "sawing off steam in chunks." We confess to liking encouragement ourselves, and during our few years in railroad service have seen many a first-class man give up trying to be smooth with either engine, brake valve or scoop because no one seemed to care whether he was doing good work or poor, or gave them the slight recognition that would have caused them to make a different showing. The T. E.'s have a big field ahead of them, and a pleasant smile or a "you did well with the '888' last month" will have in most cases a better effect than poking up with a sharp stick in shape of a letter. "Kind words are more than coronets and simple faith than Norman blood." L. D. Shaffner.

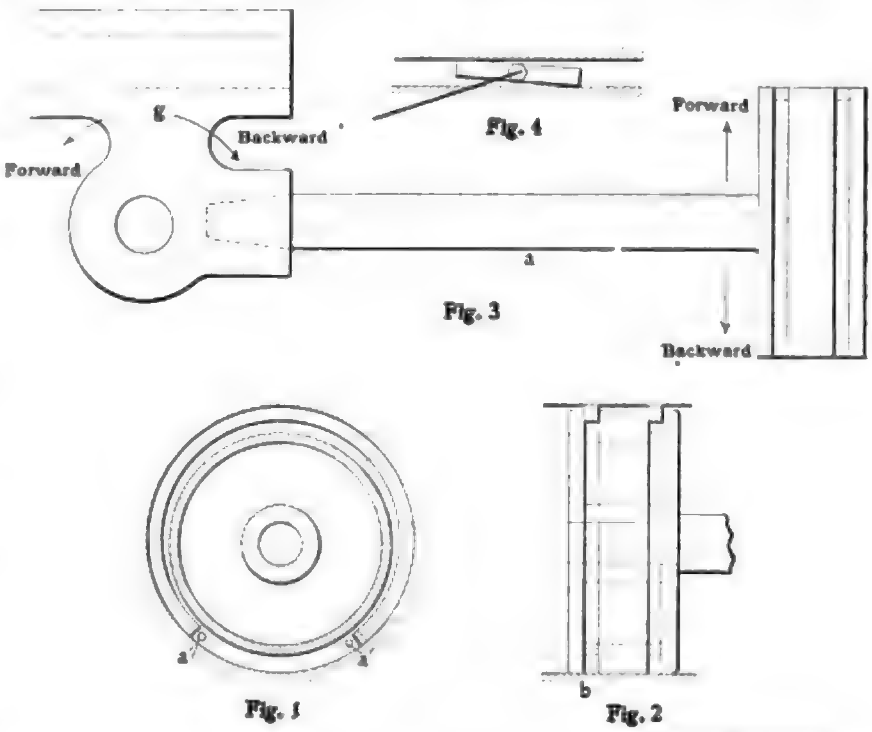
Hope, Idaho.

Cause of Exhaust Sound When Engine is Drifting.

The answer to question of I. F. Wallace, of engine exhausting when running shut off forty or fifty miles an hour is, that when reverse lever is dropped down, giving valves full travel, the pistons become suction valves sucking more air out of the steam chest and dry pipe than the relief valves can let in. When piston gets near the end of the stroke and the exhaust cavity opens, atmospheric pressure goes in to relieve the vacuum that the piston has made, making the concussion that sounds like an exhaust.

.. Thos. Reece.

Winnipeg, Man.



WEAR OF CYLINDERS.

Top Wear of Cylinders.

If we have two surfaces in contact and one slides over the other, both surfaces will be worn some. If they are of the same material, and of equal length and width, we may reasonably expect that a like amount will be worn off each surface. If one surface is comparatively long and the other short, then, other things being equal, the short surface will be more proportionately worn than the long one, as regards the thickness of the pieces having their surfaces in contact (the wear would reduce the weight of each piece the same), provided, of course, that the surface of each is of precisely the same material and condition from start to finish. Applying this theory to cylinder wear, we may expect that if the piston or rings are worn on any part of their circumference that the cylinder will suffer a corresponding wear, and *vice versa* if the cylinder is worn on the top, the rings or piston on both are accountable for it. If the piston does not show that it has been in contact with the top of the cylinder then the rings alone are "guilty."

In an emergency case, a few years ago, I had some broken rings put in as shown in Fig. 1 of the enclosed sketch, it being a section on line *a b* of Fig. 2. There was enough left of the rings to pack that part of the cylinder not in contact with the piston, and the dowel pins *a' a'* held the rings from turning in the groove. As these rings were not complained of, they were left in till worn out. Several other sets were put in with a like amount cut out of the rings. The object was to relieve the bottom of the cylinder of ring wear, which they do, of course. The only objection that I know of to such rings is that they tend to wear a longitudinal shoulder on the cylinder at the ends of the rings.

I regret that Mr. Symington, who has brought this subject up in February Locomotive Engineering, did not give more particulars of excessive top wear of cylinders he speaks of, although from reading his letter one must conclude that in the case he mentions the piston was lifted and held against the top of the cylinder while running. The question arises what could do it?

I have no theory to advance that will take the place of the cylinder in supporting the piston, neither do I see how any of those Mr. Symington has spoken of can do so without producing serious wear elsewhere. His first inquiry does not appear to call for argument. The second ditto. The third, however, it seems to me, must be answered in the negative, unless a Laird crosshead is used, and even then the top wear cannot extend far from the back end of cylinder and the engine run fast. In Fig. 3 the center of gravity of a crosshead of this kind is assumed to be at a point *g*, then as the crosshead starts forward from back end of the

stroke, its inertia tends to revolve the crosshead and all that is rigidly attached to it, around the center of the crosshead pin, with a leverage from point *g* to the center of the pin, and in the direction shown by the arrow marked forward. This force will, if sufficient, lift the piston from the bottom of cylinder. At the forward end of stroke the inertia of crosshead produces an opposite effect.

If the pull or push on the main rod is to lift the piston, when the guides are in line with the cylinder, then the crosshead must stand at an angle to them, as in Fig. 4, a condition that I do not suppose exists. J. H. Dunbar.

Youngstown, Ohio.

Uneven Wear of Cylinders.

In an article published in your February issue relative to the cause of the excessive wear in the crown of cylinders, I consider the writer has failed to touch on a most important cause for this; and in referring to his reasons it would appear to me, if the alignment of the piston and crosshead was such as to cause this amount of pressure between the piston-head and crown of the cylinder, it would be impossible to maintain piston packing or lubrication on the guides.

I have on several occasions found cylinders on the same engine, where on one side the bore of the cylinder had worn true with the line set from the counter-bore, and the other cylinder would show a wear of one-sixteenth or one-eighth more in the crown than on the bottom. In the cylinder that was worn true I found the original packing rings that had maintained their size and were a neat fit between the bull-ring and follower, and the space between the ends would permit of the admission of but very little steam. In the cylinder that had worn "out of true," I found broken packing rings, or if the rings were not broken on coming in, the shop records showed that broken ones had been taken out on that side while in service. This I consider is the principal reason for the uneven wear. One ring may break and the other may maintain a good packing so there will be no blow, and it will be permitted to run. This broken piece soon rattles loose and does no packing.

This broken end permits excessive pressure to get between the bull-ring and packing ring, and with the piece broken off reduces the area of the lower half of the packing ring, and the result is, the upper half having the larger area will produce a greater pressure against the crown of the cylinder. This friction under the ring produces increased friction and is harder to move, and the ring is soon worn loose between the bull-ring and follower, allowing more steam to get under the ring, constantly increasing the wear.

This may put another "wrinkle in the horn" of some of the counterbalance experts who find a difference in the riding of engines while working steam and rolling shut off, for this increased friction of the piston heads will surely interfere with the movement of the reciprocating weight. W. J. Torrance.

Evansville, Ind.

Why Cylinders Wear on Top.

I have heard of cases like those cited by Mr. Symington in the February issue of Locomotive Engineering; but it doesn't seem to me that he has hit the most probable cause, although he seems to have thought of almost all the possibles.

Foundrymen and machinists know that in any cast-iron body the thinner portions are always the hardest, and as the upper part of the cylinder, with its steam ports and valve face, is a much larger body of metal than the rest of the cylinder, it seems certain that it must be softer. The rings exert an approximately even pressure all round the cylinder, and it is natural that the top should wear faster than the rest, other things being equal.

As castings are very often freaky, and have hard and soft places, it is not safe to predict that wear will always come in the same place; but it seems reasonable to suppose that where the wear is excessive on the top, it is due to softness of metal, rather than to possible effects of crosshead or other parts. Next! I. B. Rich.

Honeybrook, Pa.

What Causes Flat Spots on Tires?

Messrs. Ackerman & Wardell's tests for imperceptible slip of driving wheels seem to be very complete. But how can we account for flat places in tires that invariably occur at the same places. You will observe that in about nine out of ten engines with tires that have been on any length of time, there is a flat place just about one spoke from crank, and ahead of it, in forward motion, it is usually about 7 or 8 inches long.

An idea struck me that this was probably caused by the so much talked of imperceptible slip.

Now take an engine traveling at a high rate of speed, say forty-five or fifty miles per hour. As left main pin approaches forward center main rod, piston and crosshead come to a rest, while the counterbalance is still traveling at the same rate of speed, and with help of engine on right side is doing its best to slip the wheels. Now, admitting that wheels *do* slip on bottom quarter, why not on top quarter also, and consequently make a flat spot opposite from one near crank, which is not the case?

As one wheel can't slip without its mate slipping with it, it follows that there ought to be *four* flat places on each wheel, which also is not the case. O. J. Beavers.

Waycross, Ga.

Wear of Crank Pins.

As the keying-up question has apparently resolved itself into a case of "You do it your way, and I'll stick to mine," it may be well to call attention to one point which is generally overlooked.

Some men say that the pin wears on the side toward the cylinder when it is on the lower quarter, because the pressure is on the piston, and it is moving at its fastest. On the center it is a direct pressure and no motion.

Others say the wear must be on the side of pin (outside) toward cylinder, on account of pressure there; but are apt to admit the lack of movement to cause wear.

Now, when we stop to think of it, is there any difference in the movement of the crank pin during its revolution? The piston gets tired and starts going the other way, but the crank pin keeps on turning just the same. Now as the pressure is heaviest at the end of stroke and the crank pin is also revolving just as fast as any other point, why should not the wear be in this vicinity? It seems as though it would take more than thirty-five years' experience to key up a rod which was worn half an inch out of round, with the engine on the center, so as to run as it should. And if it be just as well to adjust any engine cold, most engineers are wrong in their conclusions. I. B. Rich.

Honeybrook, Pa.

Lighting Headlights.

I saw in the December issue of Locomotive Engineering a letter on the ills of lighting a headlight on a windy night. I have found the trouble easy to overcome, by the following practice: Take a piece of pliable copper wire of small size, about 15 inches long, turn an eye on it about as large as a half-dollar to take hold of, and at the other end turn a piece ¾ inch long, at right angle to it. Now take a string of waste and wind tightly around the bend of the angle until it is about as large as a good sized pea, then bend the short piece back upon the other wire, so it will not catch on anything. If it is very windy, it is better to take the reflector out and clean the crust off the wick and put it back again before trying to light it. When ready to light, dip the little ball of waste in kerosene (but do not let it drip); take your torch and set it back in headlight house; light the waste on lighter and run it down the chimney on the wick; set the headlight burner and take your torch and go in, for your work is done.

Another thing I have found useful in oiling an engine on windy nights, when your torch is liable to go out often, is to light three or four pieces of old oily waste (which is a good thing to have on hand) and throw some under the engine, and some alongside of her, so you can re-

light your torch from them, while they will give you some extra light.

FRANK B. FROST.

Washington, N. J.

The Phoenix number of LOCOMOTIVE ENGINEERING is at hand, and it is a dandy. If you can do so well after the fire, I don't know what kind of a showing the 1899 number would have been had there been no fire.

Lighting headlights in a gale is a problem the writer has wrestled with quite often; trying to get under the lee of a scoop, soak, or any old thing, at the same time saying things not found in the book of rules. The one great trouble is that the door of the case is hinged on the wrong side. If hinged on the front corner the door could be opened wide enough to pull the lamp out sufficient to insert the left arm while holding up the chimney with the left hand. Some old headlight cases were hinged on both front and back corners.

W. DE SANNO.

Vallejo, Cal.

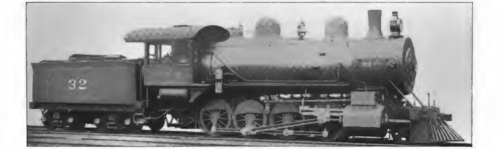
Exhaust Noise When Throttle is Closed.

I have noticed the exhaust of engines when running with throttle closed, with both the American and Richardson type of valves. The cause that I attribute to relief valves, as I have noticed that engines not equipped with them do not make this exhaust.

When engine is drifting with steam shut off, the piston is traveling away from end of cylinder with steam port open to steam chest, forming a partial vacuum, and air will rush in through relief valve and steam chest to cylinder to supply it. On return stroke the piston compresses this air and forces out through exhaust port to atmosphere, making a very distinct sound. Engines equipped with the plain or balanced valves without relief valves will not do this, as when throttle is closed. The vacuum formed in the cylinders cannot be supplied through steam chests, and on the return stroke when piston is traveling toward end of cylinder, which is open to the exhaust, air will rush down exhaust nozzle to supply it.

I think a mistake is made when running down long grades by using light throttle to lubricate valves, if by so doing it is necessary to replenish fire to keep up steam. When fresh fire is put in, considerable smoke is made, which cannot be avoided, and unless sufficient steam is used so the exhaust can be plainly heard, the vacuum in cylinders will not be supplied; consequently considerable smoke will go to them through exhaust nozzle. When light throttle is used drifting down grade ten or twelve miles, it is necessary to use five to ten scoops of coal, and some of the smoke finds its way to the cylinders, counteracting the benefits of using steam; besides the amount of coal used is quite an item—far more expensive than using a little more oil, should it be necessary. I think better results would be obtained by shutting engine off at top of grade with fire burned down, than there would be by using steam and putting in fresh fire, which will make considerable smoke.

W. L. WORKS,
Fuel Instructor, C., St. P., M. & O.



NORTHERN PACIFIC LOCOMOTIVE.

Northern Pacific Consolidation Compounds.

The consolidation freight engine here shown represents one of an order of fourteen, known as Class Y engines, built by the Schenectady Locomotive Works for mountain service on the Northern Pacific.

The weight of the engine in working order is 189,200 pounds, of which 169,000 pounds are on the driving wheels. The total wheel base is 23 feet 3 inches, and the rigid wheel base 14 feet 8 inches. The cylinders are high pressure 23 inches, low pressure 34 inches diameter and 34-inch stroke. The steam ports of high pressure side are 18 inches by 1⅝ inches; low pressure 23 by 2⅛ inches.

Allen American valves are used, which have 6-inch travel in full gear, and have 1⅛-inch inside lap on the high pressure, and 1-inch lap on the low pressure valve. The low-pressure valve has ¼-inch inside lap. The valves are set ⅛ inch blind.

Cast steel is used for the driving wheel centers and the main driving boxes are of the same material, while the others are of steeled cast iron. The main driving journals are 9 x 10, and the other 8½ x 10 inches.

The boiler, as will be seen, is of the extended wagon top type, 72 inches diameter at the front ring. The boiler is designed to carry working pressure of 225 pounds to the square inch. It is built of carbon steel and provides a total heating surface of 2,923.4 square feet, of which 202.9 are in the firebox. The grate area is 35 square feet.

The engine is equipped with Jerome packing, Ashton safety valve, McIntosh blow-off cock, Detroit lubricators, American outside equalized brake, Westinghouse automatic brake and 9½-inch pump, magnesia sectional lagging on boilers and cylinders, Golmar bell-ringer, Ashcroft steam gages; one Hancock inspirator and one Ohio injector provide the means of water supply.

Curious Action of a Dry Pipe.

The Illinois Central Company took out of Engine 316, carrying 165 pounds of steam, a dry pipe 6½ inches inside diameter, made of wrought iron 3-16 inch thick, which had been flattened while in service by the steam pressure, so the opening was closed nearly the whole length as completely as if done under a steam hammer. Very likely a dent in the pipe or a flattened spot gave the steam pressure a chance to collapse it. When it once started, it flattened the whole length from one collar at the joints to the other.

It's a good deal easier to lose a minute at a station than to pick it up on the road. If you can impress this on the conductor, it will be easier on you and on the coal pile.

Doc Sees Things Differently.

BY C. B. CONGER.

I paid my friend Doc a visit at his home a couple of weeks ago for the first time in many years. You can well believe that the air was thick with stories of old days when we were boys together; with considerable railroad talk along after supper. It is curious how two railroad men get around to that subject in a little while after they meet, and keep it up until they have to part.

This was the first time that I had met Mrs. Doc since we were boys and girls together in the same school district. She is a bright, intelligent, go-ahead, business woman—you can see very plainly where Doc gets a great many of his ideas which help him out, and that makes me remark, that lots of engineers are good or bad according to the influence their wives have over them. If they have a pleasant home they are very apt to be steady and industrious reliable men when out on the road.

Doc says their road is managed by a lot of very respectable old gentlemen who used to think that "well enough should be let alone," but now that they have got started on some of the modern ideas, they are hotter after them than a lot of young officials possibly could be. They got struck with this "two-shovel" method of firing, which is contagious out our way, and are working it for all it is worth and a little more. They have found that it is an immense improvement over the hit and miss method of loading the firebox with all kinds of coal without regard to whether the engine is burning it properly or not, yet at the same time they found out that a good many other things were required in order to make it a success. In the first place, it was discovered that in order to cut down the coal bill and at the same time have the engines steam freely, they must have the coal prepared ready for use by the fireman before it was put on the tender. Of course, with the soft coal we get in Indiana and Illinois this was not much of a job, but when they were trying some Ohio and West Virginia coal on a test it became necessary to break every bit of it. Then again they had to see that the flues were cleaned out regularly, that all the old grates which had a point burned off the fingers and a portion of the air space stopped up with clinker would have to be changed and new ones that fitted the next grate properly put in. Then the dampers came in for a general overhauling, and after all of this was done, some of them found out that the deflector plates and the netting in the front end cut quite a figure in the consumption of coal. So you see that in the midst of all our troubles in getting this new method of firing under way, we really got a great many advantages in other ways. I think in the long run this fad is a help to engineers and firemen.

When they first started this they tried to work it by circulars from the offices, giving directions as to what they wanted done, but it soon showed up very plainly that these directions must be followed out by everybody, and not by a few of the men who would have fired that way anyhow without any directions or orders from headquarters, so they appointed a traveling fireman. Maybe you don't know what a traveling fireman has to do; but the one on our road has got the busiest job he ever ran across in his life. You have heard me speak of him before, as a man who understood the business of firing soft coal in the boiler of a locomotive, right down to the "queen's taste." It is young Brown, who, as you know, is married to the nicest girl in the whole Troy family. Maybe this has something to do with my bragging him up as a good man. He has been running a couple of years and has an elegant record for economy, and he gets along so nicely with everybody that I do not wonder that he was appointed to this position. But I'll bet he wishes he was back running his engine again lots of times when he is out on the road, with some old pelter of an engine, and a crew that is tired out from being too many hours on the road.

Brown came in during the evening and said, that while we thought that everything about our engines was in good shape and up-to-date, most of them steaming good and not hard on coal, yet when business picked up and became so heavy in the last year, we began to find out that they were not good enough steamers to handle the trains as the transportation department insisted they should.

Of course the first solution of the problem was to get engines with larger boilers, having more heating surface, but the company would not do that, so the engines were changed around to get the good steamers on the heavy fast trains. In some cases this did not work, for when we put the engines which had been good steamers on freight on the fast trains they did not hold up. This led to a great many experiments with the engines in service to determine whether it was possible to get any more work out of them than we had been doing. Our traveling engineer, Ike, is quite an expert in this business, but when the officers began to appreciate that things could be improved upon in regard to the amount of coal used, and the smoke nuisance came up right on top of all of it, they started me to work to help him out by taking care of the matter of handling coal after it came on the tenders. Just about this time we adopted the "Ton Mile" base to reckon the work done by the engines, and that showed the officers a great many things about coal. Some of the engines which had stood at the top of the list for coal economy soon showed that they were doing very poor work, because they did so little of it; while other engines which had apparently burned a whole lot of coal per engine mile proved that they were hauling a whole lot of cars, and big ones at that, for every ton of coal burned. While we were talking about the "Ton Mile" base for reckoning the work done by engines, we did not forget that the rate of speed at which a train is drawn cuts quite a figure in the amount of coal used to draw it, but it made so much more work to determine exactly how much of a figure speed cuts that they have dropped it for the time being.

We had one or two engines that burned a very nice fire and used considerable coal, but did not seem to steam good. These engines were using a full tank of water on the run between water plugs that the other engines only needed two-thirds of a tank to make the distance on, and that showed to the officers that the engine using so much water could be bettered by changing the distribution of her steam in the cylinders. Oh, I tell you, Mr. Conger, this waked up a whole lot of big jobs for the traveling engineer and traveling fireman, as well as for everybody else. I will not have time enough to-night to tell you all about it.

I asked Brown what the traveling engineer, Ike, was driving at, and Doc did not wait for Brown to answer it, but said that Ike had struck a new fad. He is going over the road and getting the valves set quare. He has been at it about two weeks now, and for one day that he puts in at setting valves, he puts in three riding around in a coop up on the front end and working the indicator. He did not look very good natured when I saw him last, so there is no doubt there is something on his mind that worries him. He knocked me out of a round trip the other day because I told him that after the "478" had her valves set different, we pulled up the twelve-mile hill with one more coach, making the same time. What do you suppose he did to me? Nothing, only held the "478" in for a trip and put the indicator rigging on her, and I had to wait and go out with her on a train which had an extra car up the twelve-mile hill, and all the time he was taking indicator cards he had a fellow up in the cab to see how much steam she carried every mile and counting how many telegraph poles, so he would know how fast we ran, and timing us at all the stations.

I used to think Ike was all right, but when a new fad strikes any of these fellows, it serves them all alike; *they get it bad.*

I noticed in looking around Doc's house that he has got a good looking library of mechanical books. Most of them appear to be new. I was joshing him about being converted to the idea of learning something out of a book which he did not learn in all his years of running a locomotive. Doc says, "Yes, sir, I am converted, and know that I must go to work and catch up with the procession or get behind." (He says that instead of spending his time

growling about the way the business is done, he is inquiring why the new way is better than some of the old ones.) "What first started me thinking about it was hearing a fireman being examined for promotion, and the first question asked him was a 'stumper.' They said to him 'Trace the course of the steam from the time it is made in the boiler, through the different valves and pipes it passes, until it gets out into the atmosphere.' Now the young fellow rattled it off so fast that I could not keep up with him, and when I was thinking about it afterwards and figuring just where the steam went and how it got there and what it went there for, I was not exactly sure in my own mind whether I knew it right or whether I knew part of it wrong, and I made up my mind right there that nobody could be asked a question about a locomotive or its operation after that, but what I would try to answer it to myself satisfactorily, and I believe that it has done me lots of good. They asked this man a lot of other questions which I can answer easily enough, and I thought they left out some of the questions which I would have asked had I been the examiner; but we do not care just exactly what questions were asked and what were left out, as long as it has set one man, and that is me, to thinking that it is necessary to keep on learning all the time if you wish to become a first-class railroad engineer."

I asked Doc what he thought of the new style of firing. "New style of firing!" said he, "why that's nothing new. We have not got a good fireman on our line who tries to be economical on coal and get along without making any more smoke than the law allows, who does not fire exactly that way and who has not got onto the fact that this is the only way to fire successfully. I have talked to the firemen about this matter, and some of them only give me the laugh and say, 'Don't I keep her hot enough for you?' Others would listen respectfully, but when they opened the door, in would go four shovels of coal, one in each corner, just the way they had been told the first time they got hold of a scoop. Now, this four-shovelful business does very well, because lots of our good men have very fine success with it; but at the same time give me the other way, because I think that as the coal is burned out steadily, the supply should be put in in the same manner. That keeps the fire even, and you do not have such a large supply of fresh coal on the fire at one time. How does that strike you, Brown?" says Doc. Brown says, "That is a very good argument for the new method, but I am sure that a large proportion of our firemen do the work exactly that way, and the chief trouble with us has been to induce the rest of them to believe that it was a better way than the one which they practiced. Just as Doc says, preparing coal of the proper size to be fired, before it is put on the tender, has as much to do with it as putting in one shovelful at a time, or two. If you do not have grates that are properly adjusted and at the same level with each other, you cannot expect that the draught of air will be even up through the whole fire. Wherever the points of grates are burned off, the air space is larger than at other points, and if the grates are covered with a hard clinker stuck fast to the fingers, you can readily see that no air will come up at that point, so that even although the officers may think the increased work done by the engines and the smaller amount of coal with less smoke is due to our method of firing, yet credit must be given to the better mechanical arrangement of the engines for the purpose of saving coal. While we claim here to be an up-to-date railroad, yet a great many of these things have been neglected because the officers above us did not properly appreciate the value of having everything in perfect order if you wish to make a perfect record."

I had a long talk with Doc and Brown about the front-end arrangement of deflector plate, netting, etc., which will have to be left over till some future time.

Investigating Railway Accidents in Great Britain.

We have to acknowledge the kindness of Mr. Clement E. Stretton, of Leicester, England, in sending us a package of reports made by inspectors of the British Board of Trade on the causes of railway accidents which they have investigated. The most important thing about these reports is the thorough painstaking manner in which every accident is investigated by men with highly developed training for doing that kind of work properly. Another feautre about the reports is the genuine impartiality displayed in placing the blame where it rightfully belongs. It would be a good thing for American railroad interests if a corps of efficient inspectors were engaged to report to the Interstate Commerce Commissioners on all our railroad accidents in the same manner that the inspectors in England make their reports to the Board of Trade.

Storage Pits at Meadville Shops.

We are favored with photographs of one of the room-saving devices employed at the Meadville shops of the Erie Railroad, by Master Alton Dowdell of that place. Fig. 1 shows the pit closed, Fig. 2 the doors open and the contents of the pit in view.

Air is used to do the work. A 3-inch pipe acts as the cylinder, as can be seen on close inspection of Fig. 2. Releasing the air allows the weight of the doors to close the pit.

The pits are used for storing parts of locomotives that are being repaired and are being held to go in place on the engine. It looks like a motley collection, but they are all there and can be found when wanted.

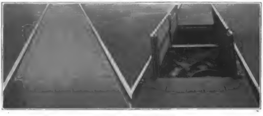


FIG. 1. FLOOR PIT FOR ENGINE PARTS. FIG. 2.

National Pneumatic Tool Co.

The National Pneumatic Tool Company have entered the ever-growing field for compressed air appliances, with a paid in capital of $200,000 and the following officers: W. Barclay Henry, president; C. H. Haeseler, general manager; Glen B. Harris, secretary, and Winthrop Sargent, treasurer.

They will make a full line of tools and appliances, including the well-known Haeseler tools, and others. The line will comprise hammers for riveting, chipping, caulking and beading; small motors for drilling, reaming, tapping and wood drilling; staybolt nippers, painting machines and other appliances.

Their offices are now No. 18 South Fifteenth street, Philadelphia, and they have doubled the capacity of the Haeseler factory in the endeavor to handle the orders which have been received.

After quite a long delay in preliminary negotiations, the railway from Quito, the capital of Ecuador to Guayaquil, on the Pacific, is assuming definite shape. Engineers are now laying out the lines, and construction will commence in a few weeks. It is to be 40-inch gage (a trifle over a meter) and laid with 50-pound rails. It is being built by American and English capital.

Locomotive Engineering

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A Code of Positive Signals.

The New York, New Haven & Hartford Railroad officials are engaged in effecting the greatest revolution in station signals that has ever been made since fixed signals were first introduced. When fixed signals for protection of trains first began to be introduced great diversity of practice prevailed. Every superintendent seemed to have notions of his own concerning what kind of signals would best inform an engineer that it was safe to proceed or that it was necessary to stop. This led to so much diversity of practice that signals which indicated danger on one railroad meant safety on another road. Within the last year, when the management of the New York, New Haven & Hartford system proceeded to investigate the condition of the fixed signals and the rules relating to the same, they discovered that on certain divisions, which had formerly been independent lines, the aforesaid confusing condition of what a signal signified existed. In proceeding to establish uniformity, the management learned a great deal about signals which had not become popular knowledge, and they used the information obtained to guide them in making changes which are calculated to greatly increase the efficiency of signals, and thereby increase the safety of travel on railroad trains.

For a long time during the history of fixed signals it was considered perfectly satisfactory to use only two forms of signals, "Danger" and "Caution." The absence of these indicated line clear. In some cases only danger and safety were indicated—one by position of arm or disk during the daytime, and of a red and white light after dark. By the grim teaching of experience, it gradually came home to those responsible for the efficiency of signals that it was very desirable that a positive signal should be given to indicate danger, caution and safety. Many an accident proved that taking the absence of a danger signal for an indication of safety was dangerous practice. The absence of a danger signal too often meant that some accident had happened to render the apparatus inoperative.

A systematic course of endeavor has been carried on for years by the American Railway Association, which consists principally of railroad general managers, to induce railroad companies to adopt a uniform system of signaling, and great good has been effected. The enlightening process carried on by this association has spread so much knowledge about fixed signals that nearly all intelligent railroad men have some ideas on the subject. Any consolidation of these ideas that we have been able to detect favors the use of red for danger, green for caution and white for clear. This inclination to employ white for clear is a hopeless yielding before the difficulty of securing a third color. Light consists of three fundamental colors—red, green and violet, and all other colors are combinations of these. Any of the combinations tends to run into or give the rays of the original color, so the attempts to find a third distinctive color have not met success. Violet or light blue gives a light of such feeble intensity that it could not be depended on to indicate the distance necessary in railroad train operating.

Using white for "All clear" has always been unsatisfactory, for the red disk frequently got broken, indicating safety when danger was intended, and there was always some danger of other white lights being mistaken for that of the signals. The likelihood of making this mistake has been greatly increased of late years through the lavish use of electric lights, which drown the light of a common oil lamp by their far-reaching rays.

The American Railway Association, recognizing these sources of danger, have inclined to recommend red for "Danger," green for "Safety" and a combination of green and red for "Caution." There are several objections to this system. The red for "Danger" is liable to become white through accident. Not only has this happened through the red disk getting broken, but the red film of inferior lenses has peeled off at times so suddenly that what was intended as a danger signal has intimated to the engineer that the line was clear. A combination of red and any other color to indicate anything except danger is a vicious arrangement that courts mistakes. Nothing ought to be done that encourages an engineer to run past a red signal. The Chicago & Northwestern and several other roads use a combination of this kind, but its use ought to be discouraged. Two lights, a red and a green, are displayed side by side to indicate caution. At a certain distance, if both lights are burning with the same illuminating power, the red alone is in evidence, and a man has to watch very closely to see the green gradually loom up to take its share as a signal. That watching puts too much extra strain upon the engineer, already overloaded with the duties of operating his engine. When the red light is burning with small illuminating power, and the green light is at its best, the latter overpowers the red light, and the man who has to control the speed of his train according to the indications of the fixed signals assumes that the signal in question tells that the line is clear and that no reduction of speed is necessary.

The shortcomings of popular practice in signaling and in the rules of the American Railway Association's Code were forcibly brought home to the New York, New Haven & Hartford people by a disastrous accident. A passenger train was approaching Whittenton Junction, and the signals were against the engineer. He slowed up at the distant signal, but seeing a white light in the signal tower which seemed calling him to come ahead, he moved up to the tower, and was run into by a train swinging in from another branch of the road. Before an investigation held by the Railroad Commissioners the engineer testified that he had seen a white light displayed at the tower, and, notwithstanding the distance signal was out, which meant that he must stop, he proceeded, as he believed the man in the tower was signaling him to go ahead. It developed, however, that in lowering the crossing gate, the lantern on the end of the arm shone through the windows of the tower, which the engineer mistook for a signal to proceed, and the accident resulted.

At another time, on the same system, a frightful accident was prevented by the alertness of an engineer, who had the "All clear" signal at a crossing with the tracks of the Boston & Albany road.

It was afterward learned that a boy had thrown a stone, breaking out the red glass in the danger signal, thereby showing a white light. At the time a train load of passengers was rapidly approaching the crossing on the Boston & Albany road, and had it not been that the engineer of the New Haven train was exercising unusual caution, a collision, attended by great loss of life, would have resulted.

These examples of the danger attending the use of white for "All clear" moved the company to discard it altogether and adopt green in its place. Under the new regulations, if a signal shows white, it means

stop, as the engineer will instantly understand that something has gone wrong. The most radical departure by this company in the use of night signals is the display of yellow for "Caution." No other railroad in the United States uses this color for a similar purpose, but that does not signify it is any the less valuable as a cautionary signal than green. The principal idea was to get rid of white altogether as an indication of safety, and this has been done.

This is not the first time that yellow has been tried as a color for signaling purposes, but, like many other things that have ultimately proved decided successes, it was repeatedly rejected because its possibilities were not demonstrated. The finding of a third light that could be successfully used for signaling purposes was entrusted to Mr. C. Peter Clark, general superintendent, and he proceeded with extraordinary energy, intelligence and perseverance to find out what was wanted. He called a great many scientific men and glass makers to his aid, and he began experimenting on lines suggested by them and on others devised by himself. His office looks like a laboratory of glass disk making products and offers many fine object lessons on colors and lenses for signaling purposes. After a great many trials and experiments he hit upon a yellow that will neither be mistaken for white nor red, and yet throws a far-reaching light that is satisfactory for signaling purposes. Early in the investigations, Mr. Clark discovered that the physical surface of the disk could be made to produce important effects upon the light displayed. He tried a variety of disks with nearly corrugated surfaces, others with roughened surfaces, and a combination between them was decided upon as the best to produce the light required, a plain circular disk being left in the center, which greatly increases the intensity of the yellow light.

While following his investigations Mr. Clark did a thing that has been too often neglected by those dealing with signaling matters. He thought that, as the signals were established for the guidance of locomotive engineers, that class of men could tell better than men theorizing in an office what was likely to be most efficient. So in all the experiments he made with different lenses he found out by indirect means what the engineers said about them. When the experiments were ended and an overwhelming number of the enginemen had expressed themselves in favor of what we will call disk "D," that was adopted.

The company are now applying the three lights to their signals as quickly as possible, and within a very short time red or white for "Danger," yellow for "Caution," and green for "Safety" will be the standard code of the road. We anticipate that the success of this system on the consolidated roads will help the American Railway Association over the stile they have wrestled with so long, and that Mr. Clark's plan will become the standard code of signals for the whole continent.

Over-cylindered Engines.

Thirteen years ago a committee of the American Railway Master Mechanics' Association made a very exhaustive investigation of the proper ratio of adhesion for locomotives, and they reported that taking 85 per cent. of the boiler pressure there ought to be at least four times the tractive power resting on the drivers for passenger engines, 4.25 for freight engines, and 4.5 for switching engines. If less weight for adhesion was allowed the engines would be slippery, even on a dry rail, and it was recognized that slippery locomotives are very expensive luxuries for a railroad company to operate. The investigation was undertaken on account of the prevailing trouble that was then experienced with over-cylindered engines, and owing to the fact that the heads of the mechanical departments of several railroads had systematically proceeded to bush the cylinders of certain locomotives notoriously given to slipping, and that they had reported decided improvements in hauling capacity and in economy from the change.

It used to be the case that locomotives were rated for hauling cars on the size of their cylinders and the diameter of driving wheels, without any regard to size of boiler and firebox provided to generate steam. This induced the operative officials to call for big cylinders, and their influence frequently led to new or rebuilt engines being over-cylindered. The agitation carried on by the Master Mechanics' Association and the light thrown upon the subject led for a few years to a general reform, but it appears to us from a careful examination of a great many recently built locomotives that the lessons of past experience have been forgotten and that it is time the railroad mechanical world were starting upon a new crusade against the over-cylindering of locomotives. The agitation in favor of the tonnage rating of trains has set superintendents, train masters and others figuring out what each locomotive ought to pull, and they naturally favor large cylinders. These people ought not to have anything to say about designing locomotives, but on many roads their influence is quite as great as that of the head of the mechanical department. When it is used in favor of vicious designing injury is done to the interests of the company, and no change not agreeable to the mechanical department should be permitted to be made without a vigorous protest.

When the committee referred to reported on the ratio of tractive power to adhesion, steam passages were much more restricted than they are in modern locomotives, and 85 per cent. of the boiler pressure was a safe factor to figure on. Designers of the modern locomotive have done so much to permit the steam to reach the pistons without restriction that it is safe to say that in most cases of engines built within the last five years 90 per cent. of the boiler pressure is available inside the cylinders while starting. That being the case the lowest ratio of tractive force ought to be 5 instead of 4. Yet very few of the locomotives built during the last year have had more than four times the number of pounds resting on the drivers that are available for turning the wheels, and in some instances the ratio of adhesion to power was very little more than 3. This will produce a crop of slippery engines that will bring grief to many people.

Reckoning the Train Load Without the Locomotive.

The amateur who can ride on a railway train and tell how many miles have been passed in a given number of minutes seems to claim an important place in engineering councils. One of these in England lately put forth the claim that the capacity of a locomotive ought not to be reckoned on the total load moved, which would include the weight of engine and tender, but on the load behind the tender draw-bar. In supporting his silly argument he said that the haulage of a horse was calculated without the weight of the horse.

Arguments of that character are hardly worth refuting, and our only excuse for returning to the subject is that many people have been mystified by them. The case of the horse is particularly beside the point, for in calculating the foot-pounds that a horse raises in pulling a wagon up a hill the weight of the horse must be taken into consideration. The true measure of the work done by a locomotive is the whole weight moved by the effort of the steam upon the pistons. The weight of engine and tender obstruct the turning of the driving wheels just as much as the same weight of cars. Then where a certain velocity is reached and it is necessary to stop, the weight of engine and tender provide the same degree of momentum to be overcome as the same weight on the car wheels.

It is hopeless, however, to convince people to sound reasoning when they have merely enough knowledge on a subject of this sort to make them pig-headed. To those anxious to find out the truth we recommend the study of a good book on elementary mechanics.

Automatic Devices for Stopping Trains When Engineers are Asleep.

Succeeding generations in this country have been familiar with inventions designed to stop a locomotive when a danger signal was against the train, no matter whether the engineer saw it or not.

We have not for several months heard from the parties interested in these inventions, but it seems now that one at least of them is trying to hold on to the ears of railroad managers on the other side of the Atlantic.

In a recent issue of the *Practical Engineer*, of Manchester, England, we read: "A simple and ingenious invention for increasing the safety of railway traveling has been patented by Mr. J. Fairley, of the National Telephone Company. It is automatic, and will supersede the troublesome fog signals. Many attempts have been made to introduce an effective self-acting apparatus which will stop a train when the signals are against it, but they have failed owing to the use of electricity or some fault of design. Mr. Fairley seems to have solved the problem in a practicable manner, and railway men would do well to keep an eye on his invention, which will be brought before the engineering world soon. It consists essentially of a kind of trigger, placed on the line at a proper distance from the semaphore, and controlled by the latter. The trigger arrangement is protected from malicious persons who might tamper with it, and a suitable contact on the locomotive is actuated by it so as to blow the whistle and shut off the steam. Thus the train is stopped automatically before it comes to the signal post, which is also there as usual for the driver to see. In foggy weather this double precaution will be particularly useful. We may add that Mr. Fairley has also applied the pneumatic system to the working of semaphores."

Cooling Hot Journals with Water.

There appears to be extraordinary nervousness among railroad men about giving their opinion of whether it is right or wrong to cool off a hot journal or crank pin with water. This arises from a prevalent fear that cooling with water is dangerous and is liable to cause fracture; but that opinion is not supported or its deductions substantiated by practical experience. In the manufacture of certain axles, dipping in cold water while the axle is red-hot is an operation employed to produce a particularly strong axle. It is not usual to dip axles in water as soon as they come away from the forge; but there is no reason for believing that they would suffer any if this was done. It is well known that dipping a piece of mild steel in water anneals it and makes it better able to withstand the stresses of bending tests. There is not a particle of evidence to prove that a car journal or an engine crank pin is not subject to the same laws that make a piece of sheet steel more ductile on being quenched in water.

In a discussion that took place on this subject at the last meeting of the Western Railway Club, all the speakers were inclined to think that it was a good plan to keep cold water away from hot journals, but no engineering idea was advanced to show what harm the water would do. One superintendent of motive power went so far as to tell that the practice of his road was to remove axles as soon as practicable that had had their journals cooled with water. We consider this very good practice in the case of any axle or crank pin that has been so hot as to require water cooling to keep it from burning the lubricants and the waste in the axle-box. In its rise of temperature the journal passes through certain stages of temperature which makes it very susceptible to initial or destructive breakage. At about 600 degrees Fahr. it reaches what is known as the critical temperature. While in that condition the journal is much more liable to fracture than it is at a higher or lower temperature, and when the axle at that heat is jolting over a rough track it is very likely that cracks will be made that will lead to accident in due course. The cooling of the axle will not increase the danger, although it is possible that sudden contraction might finish the fracture that was destined to come later.

We think that the fear of practical mechanics that fracture will result from the sudden cooling of journals and crank pins arises from their knowledge of what happens when cast iron is suddenly cooled. Yet their acquaintance with blacksmithing operations ought to dissipate any fears of this character. They see every day forgings plunged into cold water when red-hot without any damage resulting, which in itself ought to be a good object-lesson regarding the alleged danger of cooling hot journals with water.

We have frequently seen gallons of good oil wasted by pouring it on red-hot journals to cool them down sufficiently for the time to apply the contents of the water bucket. And then that would be applied sparingly, to make the cooling process as slow as possible, and the train would lose from half an hour to an hour's time on account of a groundless fallacy.

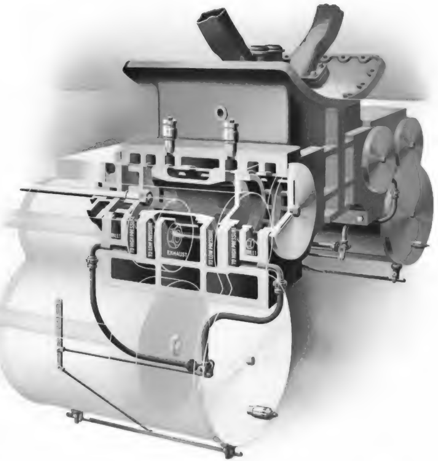
The danger likely to arise from the prompt cooling of a hot journal has a close relation to another fallacy that has been exploded over and over again by reliable tests made by scientific engineers. This is the belief that it is dangerous to pump water into a boiler whose plates have become hot through shortness of water. The belief is still widespread that injecting water into a hot boiler is almost certain to cause an explosion. To find out what there was in this theory, the United States Government made a series of tests with boilers that were purposely made red-hot, and cold water was injected into them while under pressure. In every instance the seams leaked so that the water poured into the furnaces and through every seam that had been hot; but the pressure always subsided as soon as the water entered, and there was no indication of any change likely to produce an explosion. A committee of the Franklin Institute of Philadelphia, of which Dr. Sellers was a member, watched these experiments and gave the results all the publicity at the command of the Institute; yet it does not seem to have unsettled the popular belief that cold water thrown on hot boiler plates will cause an explosion. It seems to us that the popular belief that pouring water on a hot journal will cause fracture is based on about the same foundation as the theory of injection of cold water causing boiler explosions.

Forming Trusts.

There is at present in this country something like an epidemic in the forming of trusts. There is no effect without a cause, and the cause of manufacturers in one line of business wishing to consolidate their interests is not far to seek. The chase after business has been pursued so blindly that senseless competition reduced prices below the profit limit, and those who have been in the habit of selling their products at cost, or even below the expense of production, readily listened to the voice of the tempter who invited them to enter a trust which would regulate prices. The mass of the American people do not take kindly to the forming of trusts, and it may be that a violent day of reckoning will come, as it came to England many years ago, when legalized monopolies threatened the life of the nation.

The forming of trusts has been in a great measure a means of self-protection, but the public has small sympathy for those who seek combinations to protect their interests from senseless competition. Common people rightly argue that if a baker or a butcher sells his goods without a living profit, it is fair and natural that he should become bankrupt. They cannot understand why the manufacturers of goods on a large scale should not be subject to the same principles as the baker and the butcher, and they are going to enforce the statutes against illegal combinations of capital. A practice which is against public policy may prosper for a time, but it will come to grief in the long run. We only hope that the present epidemic of trust forming may not end in a violent upheaval of our social conditions.

One of the latest phases of trust forming is of direct interest to railroad companies. Certain parties are trying to work up a trust of railroad supplies. They are working to induce railroad officials to take stock in this trust, and they intimate to the manufacturers of railroad supplies that if they do not enter the trust, the purchase of their goods will be opposed by influences sufficiently strong to have others specified. It is a very pretty scheme, but we hardly think it will work. If the promoters succeed in getting all railroad directors to enter their net, it may work for a time, but that is impracticable. If



BALDWIN COMPOUND LOCOMOTIVE -CYLINDERS, VALVE AND PORTS

they take in the leading railroad managers and purchasing agents, they will by no means control the situation. For instance, if the maker of a car coupler refuses to enter the trust, and roads that have been in the habit of purchasing his coupler should suddenly patronize others that had entered the combine, would they imagine for a moment that nothing more could be done about it? Suppose, for instance, a fighting man like Gould was made the victim. He would go around among the directors and make it so hot for his enemies that they would be glad to cry for mercy. No, gentlemen, the railroad supply trust will not succeed.

A Cruel, Miserable Fraud.

James L. Wilson, Main street, Catawba, N. C., has sent us a copy of an advertisement which reads: "Young Men—Do you want a good paying position on the railroad? If so, I can help you. Age must be between 17 and 35. Salary $800 to $1,300 per annum. Enclose 12 cents for terms, postage, etc. Address at Once."

He writes us saying: "I have 3,000 names and addresses, all received from the above ad. and fresh. I will be pleased to exchange same for space in your publication. Make me an offer. I am sure it will pay you to use them, for you will notice the ad. that pulled them. You will see that it is the cream of the country. I have 2,000 letters from same ad. that I will rent. I will exchange 1,000 or 3,000. These names are typewritten. Awaiting your reply, I am

Yours very truly."

It seems to us that this is a cold-hearted swindle that ought to receive the attention of the post office authorities. That man is obtaining the names of railroad men through that ad., and all he wants them for is to trade off something for his own advantage, the twelve cents received evidently being part of the profit expected from the scheme. We warn our readers against it, and we have taken care to place the case before the Postmaster-General at Washington.

The Baldwin Compound.

This is perhaps the best known of any of the compounds, on account of having so many in operation; and the four cylinders, two on each side, nearly always attract attention. Indeed, the valve cover in front looks like a cylinder head, and is sometimes taken for a third cylinder by the uninitiated.

We are, however, interested only in the valve at present, and, to use the words of the inventor, Mr. S. M. Vauclain, it is really two plain D valves worked into one piston valve. By following the passage of the steam this will be readily seen.

Steam from the boiler enters at each end of the piston valve through the port marked "inlet." With the valve as shown this admits steam to the right-hand end of high-pressure cylinder. At the same time the exhaust from the other end of the high is coming through the port in the valve which is over the high-pressure cylinder port, goes through the center of the valve (which is hollow), and through the port in the opposite end to the other end of the low-pressure cylinder, as marked. The exhaust from the low at the same time is going under (and around) the central portion of the valve (equivalent to the exhaust cavity of a D valve) and out through the exhaust nozzles to the atmosphere.

The piston valve which accomplishes this is clearly shown, and the action can be readily understood by a little study.

The "by-pass" or starting valve is in a pipe connecting both ends of the high-pressure cylinder, as shown. In starting from a hard place with a heavy train, this is opened and the live steam turned to the exhaust side of high-pressure piston, and thence to the business side of the low, increasing the drawbar pull by letting live steam get to work on the low-pressure piston. But as the effect is to partially balance the high-pressure piston, this should only be done when necessary. We refer the reader to the excellent article by Mr. C. G. Herman on handling these engines for further information.

BOOK NOTICES.

"Locomotive Engine Running and Management." By Angus Sinclair. Twenty-first edition, rewritten. John Wiley & Sons, New York; Chapman & Hall, London. Price $2.

This well-known book, which first appeared fourteen years ago, has been the friend, guide and instructor of thousands of engineers and firemen who were ambitious to learn the principles and best practice of their business. The great popularity long enjoyed by "Locomotive Engine Running" has been due in a great measure to the simplicity of language employed and the clearness of the descriptions. We once heard a keen critic of books remark, "One charm of the book is that you never have to read a sentence twice to catch its meaning." From time to time since the book was first published the author has made changes to keep it up with living practice; but there have been so many changes in the management and equipment of locomotives in the last seven years, that the author concluded it was necessary to practically rewrite the book or let it fall into the condition of an ancient story. The book now before us is the result of the determination to bring the work up to date. The original plan of the book is maintained—which was, to tell about the requisites for making good engineers, and giving particulars of the duties they are required to perform. How the engine ought to be cared for receives detailed attention, then the events of running a heavy fast freight train are described, and a great many particulars given of the proper way to handle the engine and the easiest way to get the train over the road. Then come several chapters concerning difficulties likely to be encountered in the running of locomotives, and the best means of overcoming them. Locomotive mechanism and attachments are described at considerable length. There is a long chapter on the Westinghouse automatic air brake, written by Mr. F. M. Nellis, which covers that subject thoroughly and is up to date. The questions prepared by the Traveling Engineers' Association have been expanded and answered by Mr. C. B. Conger. That now forms a very complete catechism that occupies forty-five pages. The book in its present form is likely to be as helpful and useful to men looking forward for promotion to-day as it was to their elder brethren who have turned to its pages for aid during the last fourteen years. It is for sale by LOCOMOTIVE ENGINEERING.

"Spon's Mechanics' Own Book: A Manual for Handicraftsmen and Amateurs." Spon & Chamberlain, New York. Price $2.50.

This is a book of 702 pages, 5 x 8½ inches, and contains a vast amount of useful information for nearly all classes of mechanics. The articles on the vast variety of subjects treated have evidently been prepared by persons who are thorough masters of the business they write about, and they have told what they had to say in simple, comprehensive language. The plan of the work is also very good. It treats first of mechanical drawing, which is the universal language of the mechanic, then comes a lengthy dissertation on raw material worked upon, its characters, variations and suitability. Then the tools used in working up the material are examined as to the principles on which their shape and manipulation are based, including the means adopted for keeping them in order, by grinding, tempering, filing, setting, handling and cleaning. A third section, where necessary, is devoted to explaining and illustrating typical examples of the work to be executed in the particular material under notice. Thus the book forms a complete guide to all the ordinary mechanical operations; and whilst professional workmen will find in it many suggestions as to the direction in which improvements should be aimed at, amateur readers will be glad to avail themselves of the simple directions and ingenious devices by which they can in a great degree overcome the disadvantage of a lack of manipulative skill.

One of the noticeable features of coal trains is the increasing number of steel cars that are being used. It is a very common sight to see half a dozen of these together in a train, and their high sides and neat appearance generally, nearly always attract attention.

Acetylene gas appears to be advancing steadily into favor for lighting purposes, in spite of the disrepute the gas fell into through explosions caused by ignorant handling. There will be an exhibition of acetylene gas apparatus held in Budapest, Austria, in May, and gold and silver medals will be awarded to those exhibiting the most meritorious apparatus designed for the manufacture or use of acetylene gas.

CORRESPONDENCE.

Handy Arrangement of Cab Fixtures.

Editor:

I send you a photograph of the inside of a cab of engine 209, Savannah, Florida & Western Railway. I think it is the best arranged of any I have seen. The brake valve is to the right of the reverse lever, where you can reach it and look out for signals at the same time. The air gage is in front of you, where you can see it. The lubricator is where you can reach it; so is the injector. ORANGE POUND,

Engr. S. F. & W. Ry.

Bartow, Fla.

One Cause for a Slow-Running Pump.

Editor:

An engine running near here recently had considerable trouble with air pumps, three pumps being tried in quick succession, all working alike, namely, very slow and blowing badly. One day the engineer discovered the exhaust tip of pump nearly stopped up. He took the same off and with liberal use of hammer pounded out the hard formation. The pump was then tried and made all kinds of speed; also air. This may be an old disease, but it is new to me. W. B. VAN HORN.

Wadsworth, Nev.

Main Reservoir Location.

Editor:

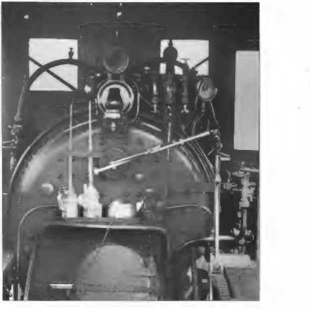
I am running an engine out of this city that came out of the shop a short time ago, equipped with air brakes. The main drum is under the deck back of firebox. In the snow and cold of last month we had a lot of trouble with the air pipes freezing up, most of the time, when running. The ash pan would fill up with loose snow from the track, causing the engine to steam bad; that is, when we had to use the back damper.

We have other engines on this road with the air drum over the frames, just back of the cylinder saddle. The air pipes did not freeze nearly so bad on these engines, and they did not get nearly so much snow in their ash pans while using the back damper.

We have a few men on this road who claim that under the deck is the proper place for the drum. Others claim most any other place on the engine to be more suitable for it. We have concluded to leave it to you to decide; also why this engine sucked so much snow in the pan. JAMES SMITH.

Bay City, Mich.

[It is quite likely that the short bends and other places for water to collect and freeze had more to do with the pipes freezing than the location of the reservoirs. A pipe covered with snow will not freeze any quicker than one exposed to the cold air. The main reservoir should be placed at the lowest point of the air-brake system between the air pump and brake valve, in order to let the water collect there and be drained off. The first place given it was under the deck; but its interference with setting up the back wedges and cleaning the ash pan from behind caused it to be moved ahead, between the frames back of the cylinder saddle. As will be seen, either of these locations, from an air-brake standpoint, is preferable to that on top of the rear of the tender. The build of the engine ofttimes forces the drum to this location, and by careful attention to drainage, entire satisfaction is had. There is little doubt that the drum under the deck causes an eddy which sucks snow and sand into the back driving boxes and ash pan through the back damper.—Ed.]



HANDY ARRANGEMENT OF CAB FIXTURES.

"Too Many Cooks," Etc.

Editor:

An amusing incident happened some time ago, and as the joke happened to fall on a general manager we won't keep it, for we don't often get a chance to joke them. The general manager referred to had got to be pretty well up on the use and theory of air brakes. He had a very nice special valve put in his car, and a duplex gage of his own design. His valve was so constructed that he could draw from the train line and set the brake, or from the auxiliary reservoir and release it. So if he happened to be on a train with a high train line (his car was braking at 100 per cent.) he would release his brake partly by bleeding the brake cylinder.

Upon the occasion referred to, the general manager's car was coupled on the rear of the regular train, and he was sitting in his observation room when he noticed that the engineer had passed a slow flag, and thinking the engineer hadn't noticed it, he applied the air gently, but made a regular emergency stop, which very much surprised him.

The unusual stop was made in a peculiar manner. The engineer could see the section men ahead, and they gave him a sig-

nal to come ahead, which he did, but he made an application to slow down just as the general manager was doing the same; and it seems that the train conductor had also seen the slow flag, and he also made a reduction, so they had a triple reduction simultaneously, which caused the sudden stop.

The engineer felt very nervous, and when he made the next stop and saw the conductor coming ahead, and the general manager following closely behind, he thought his time had come. But the conductor went to explain to the engineer, and said: "Jack, I thought you did'nt see the flag, and I just touched the valve when we stopped so suddenly. Never made so quick a stop with so small a reduction."

Then the general manager, who had just arrived, told his story and said: "Boys, that's one on me. I thought you missed the flag and I just 'touched' it when we stopped."

The engineer felt greatly relieved, but failed to confess that he had "just touched it" also, until he came to the shops, when he told his side of the story.

D. P. Kellogg,

Oakland, Cal. Gen. Fmn. S. P. Shops.

Correspondents writing for information on cause of air-brake troubles should not try to make their letters short. Write us fully and at length. If there is any cutting down we will do it.

A Cosy Air-Brake Instruction Room.

Editor:

I send you three pictures of our air-brake instruction room, put in by the Atchison, Topeka & Santa Fé Railway Company and the engineers and firemen, for the employés on the Oklahoma division.

You will notice that we have the room clean and nicely carpeted, fitted with chairs, etc., the employés paying for this part of it, as they wanted it to look nice.

We have six cars, a tender, and driver brake with gages on all cylinders, reservoirs and train line. View No. 2 shows a quiet corner. No. 3 shows bench with sectional triples, brake valves, etc. You will also notice a picture to the left given by Locomotive Engineering. We are all very proud of our instruction room, and are under lasting obligations to our genial roundhouse foreman, Mr. J. Drury, for the interest he has taken in the same.

A. L. Beardsley.

Arkansas City, Kan.

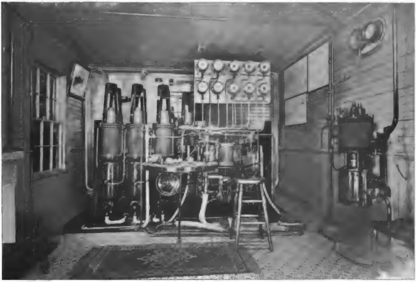


FIG. 1. AIR-BRAKE INSTRUCTION ROOM OF ATCHISON, TOPEKA & SANTA FE RAILWAY, AT ARKANSAS CITY, KAN.

Mr. W. F. Brodnax has resigned his position as general air-brake inspector and instructor on the Southern Railway, to accept the position of general car and air-brake inspector on the Atlantic Coast Line. His many friends feel every confidence in his ability to push right along to the top.

A Steam Heat Prank.

Editor:

The action taken at the Baltimore Convention of the Air-Brake Men's Association, to appoint a Committee on Steam Heat for Passenger Equipment, is believed to be of vast importance to the association as well as to railroads. The duties of air-brake inspectors being so interwoven with that of steam heating of trains, it is but pertinent that the inspector should be familiar with and able to answer all questions intelligently, pertaining to locomotive and car equipment.

Allow me to give a bit of experience wherein a "head and rear end collision" had taken place in the same train. The complaint by the conductor was "shutting off steam." After leaving a division point one cold night, it was noticed by opening the valve that a tremendous pressure was blown from the rear end of the train, having the freak. At the first stop, in about an hour's run, I climbed upon the engine and noticed the gage registered 20 pounds. My instructions were, on this train, to carry not less than 50 pounds. I called the engineer's attention to the matter, also the pressure I noticed at the rear an hour previous. He replied:

"There is trouble somewhere, and has been reported three times. Sometimes the gage is all right, and then it would run 'way up. We set the reducer at what I think is right and let it go." The writer

reported the case to the roundhouse foreman, and by test and examination everything was found all right, apparently. The pranks continued, and the brief but unpleasant experience of the train crew ended as follows:

It was not a case of shutting off steam in the cab. The dome cover was removed and the steam-heat throttle pipe was found to be loose. When the engine would round a curve, the pipe would tip over under the dome ring, and almost entirely choke off the steam. When she would lurch or sway in an opposite direction, the opening was relieved. And so it had been. The pipe was clamped, and thus ended the trouble. W. H. DURANT.

A. B. & St. H. Insp., B. & M. R. R.
Concord, N. H.

Jake Baker Takes His Third Degree in the Air-Brake Association Club.

Mester Yeditor:

It es midt fealingks so brofoundt ligke der silence I hef tu speagk on dese ocgashun. Dose vords vot cum frum der posem sthicks ven dey gidt pi der libs, undt I eggsbress sumdingks vot I tondt speagk. Der reson uf mi meloncolicnes is dis: I hef pean raised (ur lowerdt, I tondt culdt sed vich egsectly) tu der supblime tegre uf eggspurt in der Are Bragke Essosiashun Club, so uf yu vil kindtly lendt me yure eres, I vil toldt you how idt vas tu pe pungko sthered.

Es upbon al brevius ocgashuns, I vas prebared in er lidtle schmal rume oudtsidte uf der bigk rume by peingk tressedt oop in er gostum madte py excidendt fur dese ocgashun, undt midt er bare uf schlibers vat hef ust von in er bare, hoodvinckt-undt er tosthringk dree dimes tide erroundt mi pody. In dese condeshun I vas bresendted by der insidte uf der dore oudsidte, ven sumvon frum der insidte gride oudt:

"Ho vas cumingk hear?"

Ven I enseredt oudt, "Idt is me, Jake Bagker, vot hes pean hear pefor a coople ow dimes."

He esk me vot I vontedt now. I toldt him dot I vos loogkin fur moar infurmashun. He den sed:

"Yu vil vaidt undil I sea uf mi ruffens ar redy." Der bresident vos informt uf mi tesire undt hese enser returnet, vich vos:

"Ledt him ender dese essosiashun in der due forum und reseif sumdingks vot he tondt vos loogkin fur."

FIG. 3. SECTIONAL APPARATUS AND CHARTS.

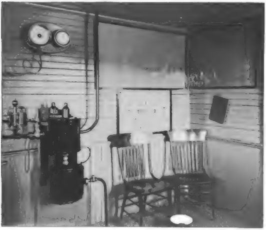


FIG. 2. COZY CORNER IN INSTRUCTION ROOM.

I vas den volkedt eroundt der rume dree dimes on der duble qwick stheps, ven sumvon sed "Haldt-wo-bagk-ub," undt esk me der saim gwestiuns es vos enseredt pefor, undt alzo esk me vere didt I cum frum undt vere I vos trefelingk. I sed I vos frum avay oudt Vest undt vos sthardet East. He sed vy I didt lefdt der Vest. I teldt him I vos on mi vay tu Detroit tu der '99 conwenshun, ver I vuldt reseif moar insthrucshun on der air bragke, so dot I culdt temandt bedter vages, mit dem I culdt brovide moar fur miselef undt femily.

He den esk me uf I vas en are bragke man. I sed I vos, undt culdt brove idt py sum pasvords undt sines. He vontedt der pasvordt, budt I sed "Nodt on yure lifes. I didtn't gidt idt dese vay. I vil gif idt tu yu on der insthalmendt blan." I den visper tu him in dree silabels der vord "Wes-ting-house." He sed, "Dis is vel. Since yu vos in bosesshun uf dese gwalifigashuns, yu vil pe conduchtedt tu der senor mogul, ho vil bost yu how tu sthart East, vich vos: Fase tu der Nordth, edvense on yure lefdt nee, bringink der toe uf der ridte tu der heal uf der lefdt, derby formingk er cirgle uf er skvare." Dis vos esy fur er feller vot tose in.

Erboudt dis dime der senor mogul sed: "Mester Bresident, der kandertate is in ordter." Der bresident sed: "Jake Bagker, pefore yu kin pecom er fulfletchedt memper uf dese Are Bragke Essosiashun Club,

yu vil hef tu tagke upbon yurself en opbligashun vot al uf us hef don pefor. Dis vil nodt inderfear mit yure bolidicle sidushun. Vas yu sthil vilingk?" I sed, "Vy, seretinly."

I vas den condugtedt tu der cender of der rume undt cosedt tu neal pehindt er nine undt er helef insh bump, mi ridte hendt resdting on er F-6 bragke velf, mi lefdt eggstendted reechingk fer er cobpy uf der 1895 *Brocedingks* uf der Are-Bragke Essoshiashun. In dese bosishun I toogk der opbligashun, bromisingk nefer tu gonseal eny uf der segrets uf dese essoshiashun so longk es I vas er memper, undt meny under dingks vot I dondt ust reckolegt dat I bromise.

Eftder dis I vos agin valkedt eroundt fer sum moar eggsersise, ven sum von toogk me py der negk undt vandted me tu gif him der pasvord; budt es he vos er sthranger tu me, I teldt him, "Nodt uf der kort nose herself, undt I dink she due." Pefore I hed dime tu skaware miselef, undt imediadely eftder sayingk dis, I sedt doun—nodt es I ushuly du, fer I sedt doun on mi ere erboudt sigxtean feadt frum vere I sthood ven I madte uce uf der erbofe eggspreshun.

I vos nodt uste tu sidtingk in dere bosishun. I dondt dingk idt ergrese midt mi constidushun. I brosededt tu gidt miselef perbendigkler, budt ven I cum ridte sidte ubp sumdingk hefy run mi noase ubp ergin, undt I feldt tiredt. I sedt down on mi odther ere. Idt vos bedter tu hef er schange. Idt vos munodtines doingk der saim dingk ofer undt ofer. Sumpody toogy mi frendtly essasin avay, undt I vos gwite bleaset ven he vos goan.

Mi noas vos schweledt tu der sise uf er rudibagker, midt der culler uf plue undt bleck. Mi glose loogkt ligke dey vos run true von uf dose pedtent sassage mesheans. I voldt nodt hef dose men's temper fur al dese vorldt. I hef pean kigkedt py er moole, feledt oudt uf er segondt-sthory vindow, lernedt der roler ringk skader pesines, road er musteng bony midt bugkingk variashuns, undt sthil gling tu life; budt al uf dese feadures ar budt von fedther in der belence cumbardt midt der resuldts uf mi eggsperiense on dese ocgashun.

Budt I hef von gonsolashun, dot I hef sum inshurense py mi lifes undt stil lif. Dis magkes me feal so hepby, ust ligke er mans vot hef tue modther-in-laws undt er supscribshun paber fer er memoriel tombp tu King Soloman, hose diregt decendtent I em. Ho toudts idt?

JAKE BAKER.

Elmira, N. Y.

The coming convention of Air-Brake Men, to be held at Detroit, Mich., April 11th, 12th and 13th, promises to be very interesting and instructive. Some excellent papers will be presented, and the discussions will be sure to be interesting.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(26) E. W. F., Frankfort, Ind., writes:

Please to answer questions numbered 19 and 20 on page 57 of Conger's Air-Brake Catechism. A.—We cannot obtain an old copy, to which you doubtless refer us. Please send us the question and answer, and we will be glad to tell you if we agree with the answer given.

(27) G. W. L., Brainerd, Minn., writes:

Will a 10-pound reduction from 65 set a brake harder than a 10-pound reduction from 50 pounds train line? I have argued this with several different people, and I think it will not. A.—The resultant cylinder pressures will be the same in both cases.

(28) L. M. N., St. Augustine, Fla., writes:

In handling a freight train of forty or more cars with air on ten or twelve front cars only, how is the best way to make a stop when backing to keep from breaking train apart? A.—The hand brakes on the caboose and adjacent cars should be used, and the air brakes be used very carefully.

(29) C. P. S., Dayton, O., writes:

I have on an engine a D-5 brake valve (1892 model) that when you make an application of brakes in service notch, you get the emergency, and when you bring the handle back on lap, the black pointer immediately goes up 10 pounds. What is the trouble? A.—There is probably a stricture in the passageway between the equalizing reservoir and chamber D. Look and see if the gasket in the coupling between the brake valve and pipe to small reservoir is not crushed into the passageway.

(30) E. T. K., Tracy, Minn., writes:

In the bushing of the reversing valve of the Westinghouse 8-inch pump is a small port leading from near the top of the bushing down the side and opening against the stem of the piston. I can find nothing in any of the works I have regarding it. Please explain its use. A.—This port provides for drainage of condensation from the top of the reversing piston, and at the same time forms a water packing for the stem. See page 49, January, 1898, number.

(31) L. M. N., St. Augustine, Fla., writes:

I often find in handling air on freight trains quick-action triples which fly into emergency application when pressure is only reduced about 6 pounds. Please tell me the cause and remedy, and do not fail to tell me how to quickly and unmistakably locate which car or cars these emergency applications are on, so I can cut them out? A.—Considerable trouble of this nature is being had just now from a make of triple valve that has not passed the master car builders' tests, and is being bought by a few railroads. The troublesome valve looks some like the Westinghouse, but a careful look will tell the difference. The method of correction used on most roads having the trouble is to cut the valve out.

(32) B. J. R., Macon, Ga., writes:

I am running a locomotive with a 9½-inch Westinghouse air-brake pump, and using a D-6 (1892 model) valve. My tender brake sticks every time I use a service stop application and will not release till engine has run from 50 to 75 feet. I have cleaned and examined tender triple several times, but can find no cause for such. I might add that I have trouble in getting my excess, and that with the light engine I usually have 86 pounds train line and 90 pounds main reservoir pressure. Will you tell me the cause of the trouble and the remedy? A.—Your brake probably sets with about the same pressure that you have in your main reservoir, and naturally would be hard to release. This trouble would be aggravated by small main reservoir, in need of draining, poor air pump, too short piston travel, and 12 x 33 auxiliary reservoir on an 8-inch brake cylinder. Look after these points and your trouble will probably disappear.

(33) B. J. R., Macon, Ga., writes:

I have great trouble in getting excess pressure of 20 pounds. When engine is light my hands stand: Train-line 80 pounds and reservoir 90 pounds; with six cars, train-line 80 pounds and reservoir 90 pounds; with fifteen cars, train-line 65 pounds and reservoir 90 pounds. I have been unable to regulate these pressures to 70 and 90 pounds, as they should be. I have tried governor and excess-pressure spring nut by tightening and loosening it, but only meet failure. Please tell me cause and remedy. My understanding is, governor controls red-hand pressure and nut on bottom of excess spring of engineers' valve controls black hand. Am I right? A.—You probably have a slight leakage past your supply valve, which does not show up except with the light engine. The uncertain action of the feed-valve attachment is no doubt caused by the piston and spring binding in some way. See that the piston works free in its cylinder, and that the ends of the spring butt squarely against the adjusting nut and under side of piston. Your understanding of the pump governor and feed-valve attachment controlling the red hand and black hand, respectively, is correct.

H. K. Porter & Co., Pittsburgh, Pa., have issued a neat book giving the story, almost without words, of their growth and present plant. Good half-tones show plainly the different departments of the works, as well as some of their products. Those who are fortunate enough to obtain a copy will preserve it for future reference. Those interested in small locomotives should see on what terms it can be obtained.

Sir Douglas Galton, K. C. B.

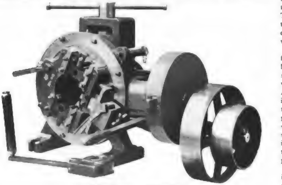
In the course of its comments upon the death of Sir Douglas Galton, K. C. B., on March 10th, and his achievements, the *Railroad Gazette* says:

"He had other honorable positions, and did other useful work; but we are chiefly concerned with his contributions to the art of train braking and to the world's knowledge of the laws of friction. In 1878 Sir Douglas, then Captain Galton, in co-operation with George Westinghouse, Jr., carried out the Galton-Westinghouse brake experiments, which have become classical. Mr. Westinghouse designed and constructed the automatic recording apparatus and doubtless laid out the scheme of experimentation. Captain Douglas Galton was chosen by the Institution of Mechanical Engineers (British) to direct the experiments. These two gentlemen worked together with great intelligence and skill, and their reports to the Institution established the facts, then hardly more than suspected, that the coefficient of friction rises as the speed of the wheels diminishes, and that the retarding effect is lessened the instant the wheels begin to slide on the rails. Thus the Galton-Westinghouse experiments and reports were an original and important and permanent addition to man's knowledge of physical laws. Few men ever have the fortune to do so much as that."

The Board of Trade of Bethlehem, Pa., is doing a little lively work in the endeavor to interest people in the Bethlehems as a place of business and residence. As the city dates back to 1741, it has much that is interesting from a historical point of view, and it has advantages which may well be considered. Among the notable works here are the Bethlehem Iron Works, the Bethlehem Foundry & Machine Company and others. The secretary, Mr. A. C. Graham, should be addressed for further information.

A New Pipe Threading Machine.

A new machine which has just been placed on the market by the Armstrong Manufacturing Company, of Bridgeport, Conn., is shown in the accompanying illustration. It is built on the same general plan of some smaller machines manufactured by the company, but it has some important modifications. The new machine will thread pipe from 1 to 4 inches in diameter. It uses the regular Armstrong stock dies, which are put into the machine and adjusted in the same manner as the hand stock. The dies can be opened after cutting the thread, and when the pipe is removed can be locked back to the standard size without resetting. This is accomplished by an automatic locking device which is operated by simply pulling a lever. This lever is an improvement over the old form of machine, and is shown at the left of the illustration.



NEW PIPE THREADING MACHINE.

The dies, however, can be adjusted to the variations of fittings the same as in the stock. All the gears and moving parts of the machine run in oil, being enclosed in a chamber which covers them from chips and dust. The die head has no teeth on the part where it fits into the shell, and forms a bearing, in this way preserving its bearing surfaces and making it impossible to get loose. In addition to this bearing being preserved by not revolving on top of the gear teeth, there is an inner journal of large diameter, thereby still increasing its wearing surface, and preventing the die head from becoming loose. A powerful self-centering vise, which exerts its power on the center of the jaw and not on the side, is used with this machine, and will hold the pipe, being threaded, with a light pressure of the lever. The construction of the machine admits of its being fastened to a bench or placed on an iron stand, which is furnished when desired. The machine here shown is designated as No. 00, and has a cutting-off attachment for cutting pipes, the same as the Armstrong Company's larger machines. The total weight of the machine, without the stand, is 370 pounds.

Russian Paper Says That the Burning of the Home Life Insurance Building Was an Experiment.

We are indebted to Mr. W. F. Dixon, Sormovo Locomotive Works, Russia, for the following article that appeared in the *Novoe Vremya*, a French paper published daily in St. Petersburg. In commenting on the article Mr. Dixon says: "I do not suppose that you knew that the destruction of your offices was merely an incident in the carrying out of an experiment, but this only verifies the old saying that one must go abroad for news." The article reads:

"The immense height of the more modern buildings in New York has necessitated the invention of a contrivance for saving the upper stories in the event of a fire. This invention consists of a pipe connected to a steam pump, which pipe, by means of a special contrivance, can be elevated, within limits, to any required hight.

"To thoroughly demonstrate the efficiency of this appliance the Americans have neither spared their dollars nor shrunk from the following experiment, which is, of course, unique in its kind. After coming to an agreement with the insurance company in whose jurisdiction the building lay, and also with the corporation of the City of New York, who shared in the expenses, a building fourteen stories high was chosen and cleared of all inhabitants and movables. The picture of the fire which we give herewith is from a photograph published by *Leslie's Weekly*.

"The experiment had a two-fold object in view. First, to test the working of the new pump, and secondly, to show the superiority of iron for building purposes over wood. In the old style of construction the walls of a burning house generally fell in, but in the present case the main body of the building, fourteen stories high, remained standing, and will speedily be restored."

"The Locomotive Magazine" bound volume for 1898, containing many illustrated articles upon the locomotive, technical and historical; also two fine colored plates of express engines, can be obtained from the publisher, F. Moore, 9 South Place, Finsbury, London, E. C., for $1.50. It makes a handsome volume and one that will be appreciated by many.

The Dayton Malleable Iron Company, Dayton, Ohio, have issued some neat circulars describing their car-door fasteners, wrenches, brake wheel and brake forks, coal picks, torches, car-roof saddle for running boards and castings for track work. The cut of the car-door fastener is done in black on a yellow ground, and is a very neat piece of color work.

The Horwich Shops of the Lancashire & Yorkshire Railway.

BY F. J. MILLER, in *American Machinist.*

The Lancashire & Yorkshire Railway runs across England from Liverpool and Fleetwood on the west to Goole and Hull on the east coast. The capital invested by the company is in round numbers $250,000,000 and the length of the road is 540 miles. In 1894, which is the latest year for which I have the figures, the road had 1,201 locomotives, which worked in that year 10,037,276 passenger and 6,475,692 freight miles, with 3,884 passenger coaches and 23,833 freight cars. Previous to 1887 the company had two shops in which repairs and construction of rolling stock had been carried on, one at Miles Platting and the other at Bury. These becoming inadequate, it was determined to build new works and to build them in the best possible manner and with every known and approved device for efficiently carrying on the work, and the shops as they stand to-day are among the most interesting industrial establishments of the world. They were erected and are now carried on under the general supervision of Mr. J. A. F. Aspinall, chief mechanical engineer, who is well known in railway circles both here and in Great Britain as a particularly able, broad minded and progressive man, and the afternoon I spent with him, first by riding in his private combination coach and locomotive, at high speed, from Manchester to Horwich, and then in walking about the immense establishment where 3,600 employés work under exceptionally favorable conditions, is now remembered as one of the most pleasant experiences of my wanderings in England.

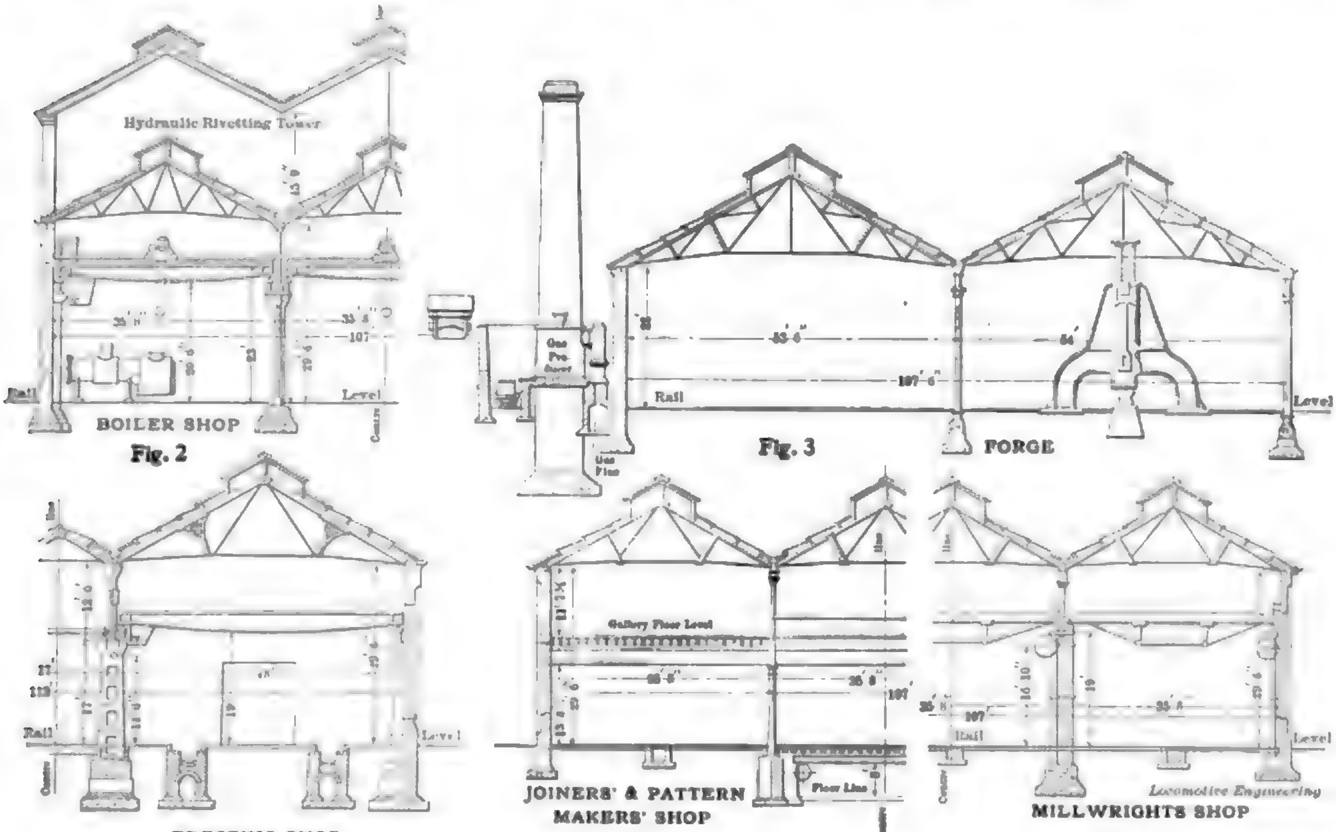
The ground inclosed for the shops comprises 96 acres, and 16½ acres of this are covered by the shop buildings, which are one story high, and, unlike too many British shops, have received especial attention in respect of heating, ventilation and lighting. Not only are the shops themselves admirable, but there are also, immediately adjoining them, a Mechanics' Institute and Technical High School, recreation grounds, gymnasium, cottage hospital and a large dining room, all maintained by the generosity of the company or of individuals interested in it.

The Mechanics' Institute was opened in 1888 and enlarged in 1893. At its beginning the shareholders of the road voted $25,000 to establish it, and Mrs. Samuel Fielden, of Todmorden, the widow of a former director, added to it the "Samuel Fielden" wing. In the building there is an auditorium capable of seating 1,000 people, and in this not only lectures but theatrical and musical entertainments as well are given, there being a large and well-appointed stage. There is also a large library, reading rooms, smoking rooms, metallurgical and other class rooms.

Science and art and commercial and elementary classes are conducted in the institute for the benefit of employés and members of their families, there being chemical and physical laboratories, with all suitable appliances, and regular examinations are held and prizes awarded for special proficiency. Engineering, photographic and shorthand societies and chess and draughts clubs, etc., are affiliated with the Institute, which is governed by a committee of officials of the company and an equal number of employés' representatives, who are elected by ballot each year.

About eleven acres of land were given by the company for a recreation ground, and, at the expense of two of the directors, Messrs. H. Y. Thompson and W. Hinmers, it has been attractively laid out as a recreation, bowling and cricket ground; Mrs. Fielden's generosity also furnishing the well-equipped and constantly used gymnasium which is connected with the Institute. Mr. Thompson, referred to above, donated the hospital, which is a model, and is under the charge of the company's surgeon and a trained nurse. At the time of my visit there was, fortunately, but one patient in it. He had an injured foot, and, in answer to the kindly inquiries of Mr. Aspinall, said that the surgeons were going to operate upon it in a few days, it being then under preparatory treatment.

There is every evidence that these feat-



BOILER SHOP Fig. 2

Fig. 3 FORGE

ERECTING SHOP Fig. 13

JOINERS' & PATTERN MAKERS' SHOP Fig. 14

MILLWRIGHTS SHOP Fig. 15

HORWICH SHOPS, L. & Y. RAILWAY.

tures of industrial life at Horwich are keenly appreciated by most, if not quite all, of the employés of the company, and a visit to the place is most inspiring to one who "has as much interest in the people who go into the shops as in the marvelous products which come out of the shops." The atmosphere which pervades the Horwich shops is a wholesome one, the relations between the employés and the management are of mutual respect and esteem. It is evidently believed that the men employed by the company are something more than mere instruments contributing to the payment of dividends, and they are treated accordingly, with, I am happy to be able to state, most favorable results in every way.

In England, much more than is the case here, railroad companies are in the habit of making practically everything used by them. The variety of things made here at Horwich is scarcely less astonishing. They commence with the manufacture of their own steel, and make all their own cars and locomotives, signals, switches and telegraph instruments. Elsewhere in this number is a plan of the grounds and cross sections of the various shop buildings. The figures and inscriptions on these will make the arrangement and proportions clear.

The man best qualified to describe the shops is obviously the one who designed and now manages them, and Mr. Aspinall, a short time ago, read a paper before the Institution of Civil Engineers with these shops as his subject. I cannot do better than to quote such parts of this paper as suit my present purpose, and therefore abstract from them as follows: The cross sections of the buildings also formed a part of Mr. Aspinall's paper, but the views made from the photographs did not, Mr. Aspinall having very kindly sent these to me, together with the drawing of the locomotive cylinders used in the description of the work of finishing these, which process especially interested me.

Mr. Aspinall, in his paper, says:

There are three entrances to the works, the "main entrance," leading to the offices and workshops generally; the "central entrance," in close proximity to the men's dining-room and cottage hospital, and the "foundry entrance," which is conveniently situated for access to the property built at that end of the works. The works were commenced in 1886, some of the shops were ready and brought into use in 1887, and by the year 1892 they were practically completed. The lighting and ventilation have been carefully studied; the buildings generally are lofty, and operations are exclusively conducted on the ground floor. Gas made at the gas-works is now in use to a great extent both for lighting and manufacturing purposes, but electric light is used in all the large shops where it is more advantageous. A complete telephonic system connects the offices and shops throughout the works. Besides the ordinary 4-foot 8½-inch gage railway connecting the various parts of the works, there is a narrow-gage railway (18 inches) traversing every part of the works, its total length being about 6½ miles. It is worked by small locomotives, which draw trains of strong trolleys conveying materials and finished work between the several parts of the establishment.

On the left of the plan, Fig. 1, are shown the chief mechanical engineer's offices, which cover an area 323 feet long by 58 feet wide. The offices for assistants, the drawing office and the office for accounts, etc., are placed at each side of a wide and well lighted corridor running the whole length and terminating at the gallery of the stores. On the ground floor is a well equipped physical laboratory, and on the top floor, immediately under the water tank which commands the whole works, is a chemical laboratory. One portion of the ground floor is used for a test room, containing a 100-ton testing machine, spring-testing machine, etc., the other portion being used for the works manager's and clerks' and timekeepers' offices. The rail-level at the stores is the common rail-level throughout the works, being 395 feet above Ordnance datum.

The General Stores consist of a two-story building, 198 feet long by 111 feet wide, formed in four bays, a gallery being built round the four sides, leaving a well for light and air in the center. The heavy goods are stored on the ground floor and the light goods on the gallery, access to which for tramway trucks, etc., is afforded by means of a small hydraulic lift, other large stores being hauled up by a hydraulic crane direct from the wagons as they arrive. A small space is set apart for the workmen who require any article from the stores, where they present their respective foreman's ticket.

The Boiler Shop, Fig. 2, is 439 feet long by 111 feet wide, formed in three bays, the first being used for building and repairing boilers, the middle bay being used for miscellaneous work, including tenders and tanks, while the third bay is used exclusively for tools, such as drilling, punching and shearing machines. Over each bay, and running the whole length of the shop, is an overhead traveling crane with a longitudinal traverse of 150

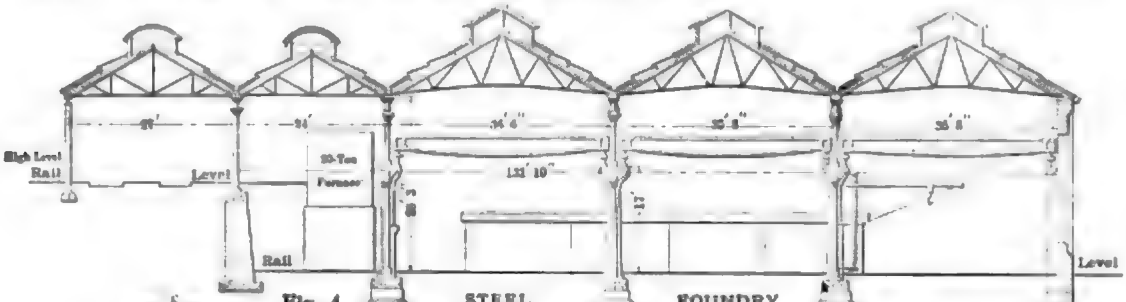
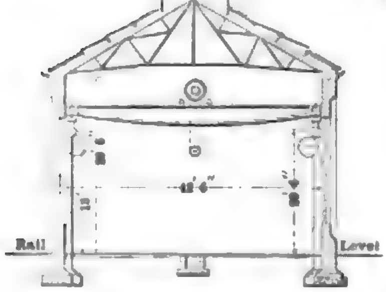
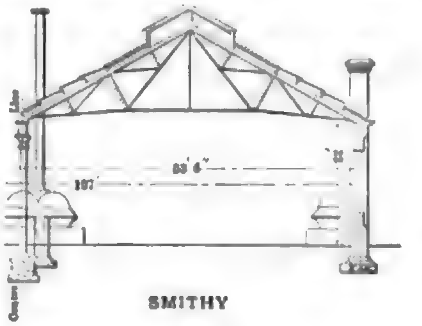


Fig. 4 STEEL FOUNDRY



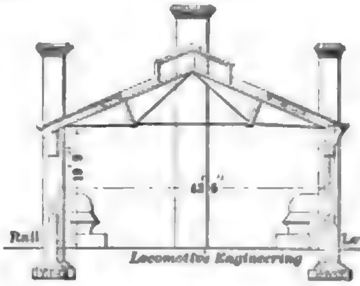
FETTLING SHOP

Fig. 7



SMITHY

Fig. 8



SPRING SMITHY

Fig. 9

HORWICH SHOPS, L. & Y. RAILWAY.

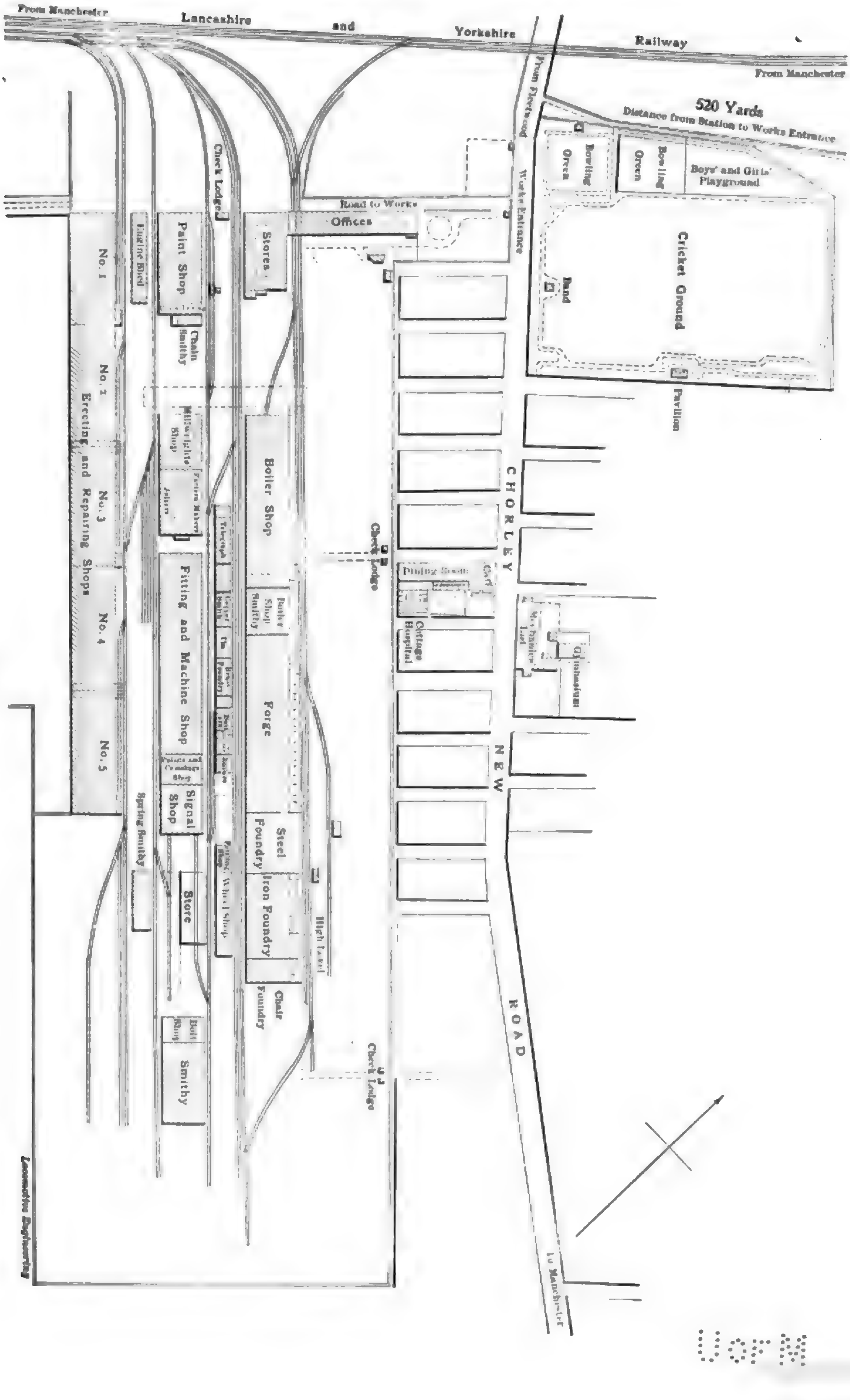


Fig. 1
HORWICH SHOPS, L. & Y. RAILWAY.

feet per minute, driven by a rope. The small rivet furnaces in this shop are fired by liquid fuel injected by compressed air. At the end of the shop the roof is carried some 16 feet higher for two spans and the full width of the shop, to form a riveting tower. In this space is provided a pair of hydraulic pumps and accumulator, and two fixed hydraulic riveters for boiler work, each having a hydraulic crane for lifting the boilers when riveting. The longest boiler can be riveted in a vertical position. Liquid fuel furnaces are fixed in close proximity to the cranes and riveting machines. Portable hydraulic riveting machines are used in every case where it is possible.

The Boiler Shop Smithy, which is an adjunct to the boiler shop, measuring 120 feet long by 111 feet wide, formed in two bays, is fitted with several smiths' hearths, dome fire, etc. The hydraulic flanging presses are also fixed in this shop for flanging firebox backs, tube-plates, etc., gas furnaces being built near them for reheating the plates.

The Forge, Fig. 3, 452 feet long by 111 feet wide, formed in two bays, contains the necessary heavy tools for the work required on the railway, the forgings being heated in the gas furnaces. At the back of the forge are the gas producers, and, the natural formation of the ground at this point being 14 feet higher, the producers are charged direct from the top, while the ashes are drawn out at the bottom through a water-seal into tram-wagons on the lower level, no hoisting being required. The scrap is cut up on the high level, and is conveyed through a conveyor into the forge, where it is made up in piles for the furnaces.

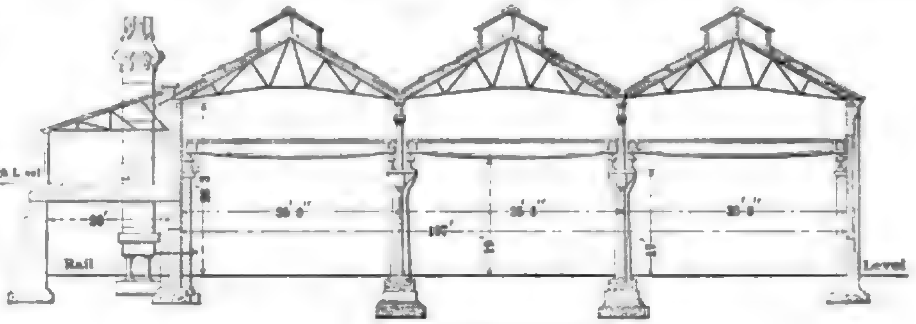
The Steel Foundry, Fig. 4, measuring 150 feet long by 135 feet wide, formed in four bays, contains one 20-ton and two 10-ton Siemens-Martin regenerative melting furnaces, heated by gas from their own series of gas producers. The advantage of the higher ground at the back also proves most economical, as the metal can be run directly into the charge holes without crane power. A high-level tramway has been fixed to carry the steel ladle on small cast-iron columns and also one at right-angles to it. The middle bay is provided with an overhead rope driven traveling crane, which travels also the full length of the iron foundry. The core stoves are fixed in the bay nearest to the high level. In the bay where the molding is performed small hydraulic cranes have been fixed against the columns to deal with the molding boxes.

The Iron Foundry, Fig. 5, 212 feet long by 111 feet wide, is also formed in three bays. The shop is used for general castings, not only for locomotive work but for those used in connection with the permanent way, the signaling and the carriage and wagon departments. There are two cupolas at the back of the foundry, the natural formation of the ground at the back proving most advantageous, as it permits the coke and iron to be unloaded and wheeled direct to the charge-holes of the cupolas.

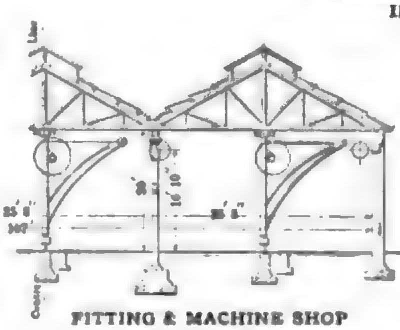
The Chair Foundry, Fig. 6, which is an adjunct to the iron foundry, is 62 feet long by 111 feet wide, in three bays. It is exclusively used for the manufacture of chairs for the permanent-way department, and has two cupolas fixed at the back similar to those of the iron foundry. A feature of this shop is the fettling-bench available for working at each side. After the chairs are cleaned they are placed on the endless chain running in the center of the bench and are conveyed direct to the wagons, which are on a lower level than the common rail level of the works.

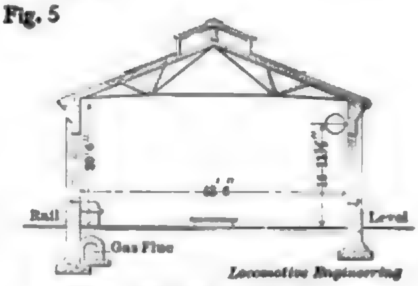
The Fettling Shop, Fig. 7, 90 feet long by 47 feet wide, in one bay, is used for cleaning castings after leaving the foundries, and is also provided with two double annealing furnaces heated by gas.

The Wheel Shop, 165 feet long by 47 feet wide, in one bay, is next to the fettling shop, being separated from it by a partition wall. After the wheels have been fettled they are taken to the lathes to be bored and turned, and are then loaded direct into the wagons which are run into the shop, the hauling being performed by an overhead rope driven traveling crane running the whole length of the wheel shop, smaller swing cranes being used for the different lathes fixed to the walls. The carriage wheels are also put together in this shop, and a special hydraulic press is provided for forcing the wood blocks between the wheel center and the tire as well as another press for forcing the wheels on the axles.



IRON FOUNDRY
Fig. 5


FITTING & MACHINE SHOP
Fig. 10



BRASS FOUNDRY
Fig. 11

HORWICH SHOPS, L. & Y. RAILWAY.

Close to the foundry, connected by the 18-inch tramway, a space is allotted, fenced in with wrought iron fencing, for the storage of spare and stock castings.

The Bolt Shop, 60 feet long by 111 feet wide, formed in two bays, contains modern bolt and nut making machines, rivet and nail making machines, and drop stamps for light smithy work.

The Smithy, Fig. 8, is a continuation of the bolt shop, measures 212 feet long by 111 feet wide, and is likewise in two bays. It is a spacious and well-lighted building, containing thirty-three single hearths along the outside walls and eleven double hearths along the middle. Between the hearths are placed at intervals small steam hammers. The blast for the fires is produced by a Root blower, fixed at one corner of the shop.

The Fitting Shop, Fig. 10, 508 feet long by 111 feet wide, is formed in three bays. Along each, traversing the full length of the shop, is a walking crane driven by a rope for the haulage of heavy materials from one machine to another. There are four lines of shafting running down the shop, driven by two large wall engines at one end. A space is allotted to the cylinders which are brought from the foundry to be bored, drilled, studded and finished before being sent on to the erecting shop. A number of milling tools, both horizontal and vertical, are provided, almost all the engine motions being completed by this class of machine; while the usual machine tools, such as drilling and slotting machines and various kinds of lathes, are arranged in their different classes. One portion of the fitting shop is allotted to the brass finishers, and close to the brass finishers' side is the tool room which supplies and repairs

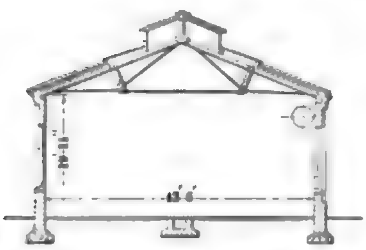
all the milling cutters, twist drills, taps and other tools required for the various machines in the fitting shop. At the lower end the setting-out benches are fixed and all the fitters' benches where the small amount of necessary hand work is done. The shop is heated in winter by pipes carried in trenches along the middle of each bay, covered with chequered grating which serves also for tram-lines, grooves being cast in it for this purpose. The shop is lofty and well lighted. The artificial light is afforded by inverted arc-lamps of 50 candle power fixed under large white painted wood disks suspended from the principals, which help to throw the light upon the machines without sensible shadow.

The Telegraph Shop, Fig. 12, 153 feet long by 47 feet wide, in one span, is provided with special tools, lathes, etc., for making and repairing telegraph and block instruments, and other electrical work. A small room is set apart for experimental work and for testing instruments.

The Erecting Shops, Fig. 13, 1,520 feet long by 118 feet wide, are divided into two large bays and one smaller bay in the middle of the shop. The outside bays are used for the repairs and renewals of locomotives, the small middle bay being used for the fitters' benches and for small tools, such as drills, placed in suitable positions along the shops, and for the storage of materials. The erecting shops are divided into Nos. 1, 2, 3, 4 and 5 respectively. No. 1 shop is used for the erecting of new tenders and repairing of existing stock. Of No. 2 shop about one-quarter is taken up for boiler mounting, the boilers being received from the boiler shop are here fitted with tubes and the brass mountings; they are also tested both with water and steam before being sent to the erectors; the other three-fourths of the shop are taken up with general locomotive repairs. Nos. 3 and 4 shops are exclusively used for locomotive repairs. No. 5 shop is mainly used for locomotive repairs, but a small portion is set apart for new work. Each outside bay of each erecting shop is provided with two 30-ton overhead traveling cranes, making twenty in all. Wheel-lathes are provided at various parts of the erecting shops for dealing with the wheels taken from locomotives under repair. A number of portable hydraulic riveters are also provided. Access for locomotives to the center portions of the shops is provided by two traversers.

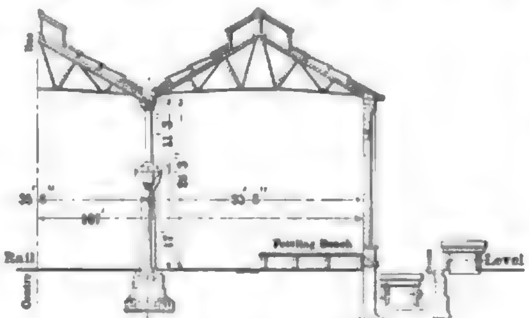
The Pattern-Makers' and Joiners' Shop, Fig. 14, 164 feet long by 111 feet wide, is divided into three bays, one being exclusively used by the pattern-makers with the drawing stores at one end. The middle bay is fitted with the most modern wood-working machinery, such as circular saws, general joiner, planing and molding machines, etc., and the third bay is divided into two portions, one-half being used by the joiners and the other half by the saddlers for repairing and renewing the belting, etc., of both the indoor and outdoor departments. Along each side bay and across the ends a gallery has been formed for the storage of patterns and other work. A sprinkler arrangement has been fixed in this shop, both on the ground and gallery floors, as a precaution against fire.

The Engine Shed is provided for stabling the locomotives used about the works.



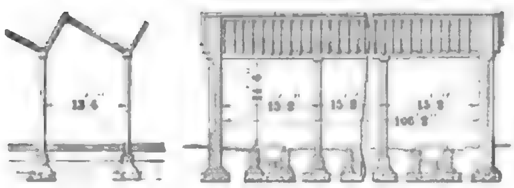
TELEGRAPH SHOP

Fig. 12



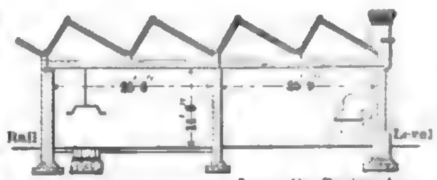
PART CHAIR FOUNDRY

Fig. 6



PAINT SHOP

Fig. 16



CHAIN-TESTING SHOP CHAIN SMITHY

Locomotive Engineering

Fig. 17

HORWICH SHOPS, L. & Y. RAILWAY.

Where Pneumatic Tools are Made.

A visit to the Boyer Works, at St. Louis, Mo., where the specialties of the Chicago Pneumatic Tool Company are manufactured finds them very busy on orders for all the styles of air hammers, for caulking and chipping tools, drilling and tapping machines, as well as wood-boring machines for use under and above cars or at any point where the boring machine must be brought to the work.

The factory is about new, and is arranged specially for doing this work, being well supplied with special machines for making the small and intricate parts of the air hammers and air engines for the drills and boring machines.

Nearly all of these small parts are made from the solid bar of steel by automatic machinery designed specially for the purpose, which finishes the parts both inside and outside at one operation. These machines do their work so exact that polishing off the tool marks will make the air-tight fits required. Of course they are fitted to gages for every dimension and then hardened. The factory is very well lighted and ventilated. The employés work on day work, and more care is taken to turn out good work than to make a record of a large amount per day.

A great deal of the success of these tools is due to the care taken in their manufacture. They are being shipped all over the world, and their sale and use are increasing faster than the capacity of the works.

The works remind one of a gun or small arms factory; there are so many gages and instruments of precision used at every stage of the manufacture. The Boyer speed recorder is also made here. There is a brisk foreign demand for these little machines, as well as the home trade in them.

The Prussian State railroads have just adopted new rules for the transportation of bicycles. The charge for all distances is 50 pfennigs—12 cents—which is paid at the ticket office for a "bicycle ticket." On receiving this ticket, which is given only with a ticket for passage, the holder, at least fifteen minutes before the train starts, must take the wheel to the luggage office to be labeled with the name of the station to which it is going. Lanterns and all luggage except the tool bag must be detached. Then he must himself take it to the platform. There a luggage man receives it and gives the cyclist a check, which declares that the company is not responsible for damage to the unpacked wheel. In case of changing trains, the wheelman must himself transfer his machine from one train to the other. The bicycle ticket, as well as the passage ticket, must be presented to be punched at the platform gate, and only on presenting it at destination is the wheel delivered. Altogether the system seems likely to end in confusion.

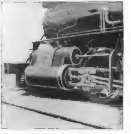
The Central Exhaust Locomotive.

At last the locomotive is safe from the onslaught of electric motors, compressed air machines, and by the use of central exhaust cylinders all that is desired in the way of high speed and economy can be obtained—if the claims of the patentees can be proven. The illustration will show the peculiarities of the engine, the extra long cylinders and steam chest being the distinguishing features.

The engine is a 21 by 28 consolidation, but the cylinders are 72 inches long, and the valve chest 82 inches long, outside measurement, while it is over 10 feet from center of front driver to center of truck.

It bears the patent plate of the Cleveland-Peterson Company, who have been experimenting on the Intercolonial Railroad for some time, and who have at last induced the road to order a new engine with this contraption.

This coming engine is the central exhaust scheme of the Cleveland-Peterson



CYLINDER AND VALVE OF CENTRAL EXHAUST LOCOMOTIVE.

Company, who have been experimenting on the Intercolonial Railroad for some time past, and who have just had a fine consolidation built at Baldwin's. It is a fine-looking engine, and even the oddity of the extra long cylinders will not be considered—if it does all that is claimed.

In reality it is the old Roberts central exhaust with the exception that it has two exhaust ports in the center instead of one —to have something to patent, or the claims wouldn't have been allowed. Roberts, the oil well dynamiter, who coaxed reluctant wells to give up their oily treasure with the mild persuasion of a dynamite cartridge, got the idea in about 1870, and had one made which was tried on the Lake Shore road and which isn't being used to-day. Further comments are unnecessary.

One of the patentees was explaining the beauties of the device to an old engineer, who had just remarked that he didn't know Baldwin had gone to making sewer pipes, when the patentee tackled him, and the writer listened.

"Yes, the cylinders are long, so are the valves, but the valves are piston valves, perfectly balanced and you can move this with one finger."

"Ever try it?"

"No, but it must move easy being balanced."

"Well if you handled the engine I do every day, I'm d—d if you'd think it moved itself—it's a piston valve, too. And, by the way, have you made any inquiries about piston valves here? No! Well then let me tell you that we break more valve stems on piston valves in a week than we do slide valve stems in a year. P'raps it's because they move too easy."

"They don't make them right. Steam gets under the rings and sets 'em out. These rings fill the groove clear to the bottom so steam can't get under."

"How about when they wear a sixteenth?"

"Well, that's only a sixteenth for the steam to work on. But let me tell you about the piston. There's a double-head or spool piston. When one end exhausts it goes to the middle of the piston, between the heads or out the stack. This relieves back pressure and at the same time warms the cylinder with the exhaust steam so there can be no condensation.

"See what we gain. No back pressure (atmospheric exhaust line), consequently no limit to speed or hauling power, and she can pull just as big a load up hill as she can down, at any speed. No condensation, so there's no loss from that score, and when we've got through testing her on the Hellertown hill you'll see what she can do."

The old engineer was just at the popping point and he couldn't hold in any longer. We'd like to use a few of his adjectives, as they were picturesque and appropriate, but we refrain.

"Hold on, stranger, don't go too strong just yet. I want to know what kind of steam you use. If it's some new-fangled kind all right, but our United States steam don't act that way.

"You say you exhaust down to atmosphere so as to have no back pressure—that means 212 degrees. You use this to warm the cylinder so steam at 200 pounds—about 380 degrees—won't condense. Darn funny steam I call that. Then what drafts your fire if you don't have any back pressure on your pistons, or do you make steam in a new-fangled way, too? And as for hauling loads up Hellerstown hill as fast as you can down —you either mean the old sewer pipe won't run at all, or else you think we're a lot of jays.

"And when I see you skating that old bird eighty miles on any part of the road, I'll go up to Canada and shovel snow for a living."

The old man was wrathy, but he knew what he was talking about at any rate, and the theory of reheating the cylinder with exhaust steam needs no further comments.

The pony truck is hardly within speaking distance of the front drivers, and there seems to be room for an observation car or extra freight on her front end—but they had to get it ahead of the cylinders.

All told, it's about as nervy a piece of business as we've seen lately, and yet the patentee claims the Dominion Government is backing him. We have always had too much respect for the Government of Canada to credit this, and trust there's no truth in this.

Main Line Switches.

We recently saw a wreck which seems almost inexcusable, and which, it is safe to say, will not happen again at that point. For convenience in shifting, there was a direct cross-over track from one main line to another, so that a train coming down the main line could be run over on the up track if the switch happened to be wrong.

This was exactly what happened: The cross-over had been opened to allow some shifting, and was not closed before the train came down the main line. To make matters worse, it was a common hand switch, was not controlled from the signal, and had no distance signal, only a small home signal quite near the switch. This is the part for which there seems to be no excuse, for it is bad enough to have a direct cross-over, even if connected to tower and signals.

While it may be a little inconvenient at times, it is decidedly safer on main lines to have all cross-over switches run backward, so that a train going in its proper direction on either track cannot cross to the other track, even with the switch open. This can readily be done by having the switches so arranged that it is necessary to pass the switch, back over on the other track, and then proceed as before. This isn't advocated for yards or side tracks; but for main lines it is a necessity when safety is considered.

One of the greatest obstacles to the smokeless firing of locomotives is the sudden change in the amount of work which the engines are called on to do. This is almost annihilated in the stationary boiler, as the work is much more constant; yet we see clouds of black smoke pouring from factory chimneys that would call down official wrath on the heads of the locomotive fireman who would allow it. Considering the smoke nuisance in cities, we would suggest that stationary boilers form one of the first points of attack.

The Erie people are said to be arranging to have large well-ventilated cars built for the transportation of horses.

The Pratt & Whitney Company, of Hartford, Conn., are now prepared to furnish both the International and the British Association standard threads in taps and dies and in any desired quantities.

PERSONAL.

Mr. J. M. Robertson has been appointed assistant master mechanic of the Wabash at Ashley, Ind.

Mr. James Casey has been appointed air-brake inspector of the Soo Line, with headquarters at Minneapolis, Minn.

Mr. Chas. F. Franklin has been appointed superintendent of the Ohio Southern, with office at Springfield, Ohio.

Mr. A. W. Niles, traveling engineer on the Baltimore & Ohio at Garrett, Ind., has resigned to take a position as passenger engineer.

Mr. J. G. Justice has been appointed as general foreman of the Plant System at Waycross, Ga., vice Mr. S. M. Roberts, promoted.

Mr. S. Phipps, road foreman of the Canadian Pacific, has been promoted to the position of assistant master mechanic at Winnipeg, Man.

Mr. G. W. Twining has been appointed engineer of maintenance of way of the Central of New Jersey, with office at Mauch Chunk, Pa.

Mr. Richard English has been appointed master mechanic of the Rio Grande Western at Helper, Utah. He was formerly with the Santa Fé Pacific.

Mr. T. A. Joynes, purchasing agent of the Baltimore, Chesapeake & Atlantic, has been made general superintendent, with headquarters at Baltimore, Md.

Mr. E. E. Shackford has been appointed general manager of the San Antonio & Gulf, with office at San Antonio, Texas, vice Mr. Geo. Dullnig, resigned.

Mr. J. W. Reading has been appointed superintendent of the Manistee & Grand Rapids, vice Mr. A. D. Hart, resigned; headquarters at Manistee, Mich.

Prof. Goss, of Purdue University has been granted a leave of absence and is going to spend from six to eight months in England and traveling on the continent.

Mr. W. F. Mackenzie has resigned as traveling engineer of the Mexican Central to accept a position with the Waters Pierce Oil Company, Mexico City, Mexico.

Mr. H. H. Hale, formerly superintendent of air brakes on the Duluth & Iron Range, has been appointed roundhouse foreman at Tracy, Cal., for the Southern Pacific.

Mr. C. F. Westcott has been appointed trainmaster of the Knoxville division of the Southern Railway, with headquarters at Knoxville, Tenn., vice Mr. B. O. Payne, resigned.

Mr. G. K. Halley has been appointed night foreman of the Baltimore & Ohio roundhouse at Garrett, Ind., vice Mr. Thomas Conners, transferred to South Chicago.

Mr. Clark L. Pierce has been appointed general superintendent of the Ogdensburg & Lake Champlain, with headquarters at Rutland, Vt., in place of Mr. C. N. Chevalier, resigned.

O. J. Kelly has been appointed division master mechanic of the Philadelphia, Baltimore and Valley divisions of the Baltimore & Ohio Railroad, with offices at Riverside, Baltimore.

Mr. George P. Wilson, well known to many of our readers, has accepted a position as general manager of the Asbestos Manufacturing Company, 426 Market street, Philadelphia, Pa.

Mr. Benjamin Norton has been appointed general manager of the Ohio Southern, with office at Lima, Ohio. He was formerly second vice-president and general manager of the Long Island.

Mr. S. F. Forbes superintendent of the St. Paul shops of the Great Northern, has been appointed purchasing agent, with office at St. Paul, Minn., in place of Mr. J. W. Blabon, promoted.

Mr. H. A. Parker, second vice-president of the Chicago, Rock Island & Pacific, has been appointed general manager of that road, to succeed Mr. W. H. Truesdale, resigned; office at Chicago, Ill.

Mr. James Hocking, general foreman of the New York, New Haven & Hartford, has been promoted to the position of master mechanic at New Haven, Conn., in place of Mr. J. W. Leary, resigned.

Mr. W. A. Barnard has been appointed train dispatcher of the Minneapolis division of the Minneapolis, St. Paul & Saulte Ste. Marie at Enderlin, N. Dak., vice Mr. G. S. Baxter, transferred.

Mr. J. Jeffries, foreman of locomotive repairs of the Queen & Crescent at Meridian, Miss., has resigned. He has been with the Queen & Crescent for eighteen years and retires to a long-needed rest.

Mr. N. W. Chapman has been appointed assistant superintendent of the Eastern district of the Nebraska division of the Union Pacific, with headquarters at Omaha, Neb., in place of Mr. E. R. Griffin, transferred.

Mr. W. D. Sargent, president and general manager of the American Brake Shoe Company, Chicago, was married last month to Miss May Partridge, the daughter of one of Chicago's most substantial citizens.

Mr. W. W. Maguire, superintendent of the New York division of the Erie, has resigned to accept a position with the Delaware, Lackawanna & Western, in charge of the New York and New Jersey terminals and the floating equipment.

Mr. C. P. Eckels has been appointed superintendent of the Minnesota division of the Minneapolis, St. Paul & Sault Ste. Marie Railroad, with headquarters at Enderlin, N. Dak., vice Mr. F. C. Batchelder, transferred to the Wisconsin division.

Mr. C. Curtis, who has been master mechanic of the Mexican Railway at Apizaco, Mexico, for twenty-five years, has left the service, and was presented with a gold watch and chain by the men in the shops as a token of their esteem.

Mr. F. C. Batchelder, superintendent of the Minneapolis division of the Minneapolis, St. Paul & Sault Ste. Marie, has been appointed superintendent of the Wisconsin & Peninsula division, with office at Minneapolis, vice Mr. D. Willard, resigned.

Mr. T. M. McDonough having resigned as master mechanic of the Alabama Midland Railway, or Third division of the Plant System of railways, Mr. W. H. Dyer was appointed as master mechanic in his stead with office at Montgomery, Alabama.

Mr. E. T. White, master mechanic of the Baltimore & Ohio at Riverside, Baltimore, Md., has been appointed superintendent of motive power of the lines east of the Ohio River, in place of Mr. I. N. Kalbaugh, transferred; headquarters at Baltimore, Md.

Mr. I. N. Kalbaugh, superintendent of motive power of the Baltimore & Ohio east of the Ohio River, has been appointed to succeed Mr. W. H. Harrison, resigned, as superintendent of motive power of the lines west of the Ohio River; headquarters at Newark, Ohio.

Mr. S. M. Roberts was recently promoted from the position of general foreman of the Plant System at Waycross, Ga., to that of acting master mechanic of the Brunswick & Western Railroad, with headquarters at Brunswick, Ga., vice Mr. W. H. Dyer, transferred.

Mr. John Forster has been appointed master mechanic of the Colorado & Southern, with office at Denver, Col., vice Mr. J. J. Cavenaugh, resigned. Mr. Forster was formerly for several years master mechanic of the Atchison, Topeka & Santa Fé at La Junta, Col.

Mr. E. R. Hoadley, secretary of the Florida Central & Peninsular Railroad Company, has resigned and accepted a position as assistant treasurer of the American Car & Foundry Company. He will commence his duties at their headquarters in St. Louis April 5th.

Mr. J. C. Ford has been appointed superintendent of the railroads of the Pacific Coast Company, with headquarters at Seattle, Wash., vice Mr. L. E. Smith, resigned. Mr. Ford was formerly superintendent of the St. Paul & Dubuque division of the Chicago Great Western.

Mr. D. Willard, superintendent of the Wisconsin & Peninsula division of the Minneapolis, St. Paul & Sault Ste. Marie, has resigned to accept a position with the Baltimore & Ohio as assistant general manager in charge of maintenance of way department east of the Ohio river; headquarters at Baltimore, Md.

Mr. Robert B. Reading, who was for years a division master mechanic on the Manhattan Elevated Railroad, went to the

Klondyke two years ago and has been back this winter to thaw out. He has gone back to the frozen wilds of Alaska, but he was considerate enough to leave us a collection of photographs of railroad and other scenes in that region, which will grace our pages in the near future.

Among the delegates at the St. Louis Convention of the Brotherhood of Locomotive Engineers at St. Louis last year was Mr. W. Haverstick, from Waukesha, Wis. Mr. Haverstick was an engineer on the Wisconsin Central and was highly popular among railroad men and others. Shortly after the convention he was appointed major and paymaster in the Volunteer army. He is now stationed in New York City.

Mr. Michael D. Wild has been made secretary of the Baltimore & Ohio South Western Railway, succeeding Edward Bruce, and assistant secretary of the Baltimore & Ohio Railroad, with headquarters at No. 2 Wall street, New York. For several years Mr. Wild has held a very responsible position with the Baltimore & Ohio Railroad in Baltimore, and the change is a promotion and recognition of his valuable services.

Mr. G. R. Henderson, mechanical engineer of the Norfolk & Western, has resigned to accept a position with the Schenectady Locomotive Works. Mr. Henderson is a graduate of the Pennsylvania Railroad, and is one of the ablest mechanical engineers engaged in railroad work. He has prepared some excellent reports for the Master Mechanics' Association, and his papers for the American Society of Mechanical Engineers have brought him much credit.

Our friend, Mr. J. Snowden Bell, attorney-at-law, has sent out a notice that his office has been removed to 915 Park Building, Pittsburgh, Pa. On the postal card announcing the notice is a picture of one of the original camel-back locomotives of the Baltimore & Ohio. We think that Mr. Bell made a mistake in associating himself with a machine that was ancient years ago. If he wants to associate himself and his way with a locomotive he ought to have chosen the very latest and most modernly-equipped locomotive in the world.

The following changes have been made on the Chicago, Rock Island & Pacific Railway: Mr. A. L. Studer has been appointed assistant superintendent of motive power and equipment on lines west of Missouri River, with headquarters at Horton, Kan., vice Mr. J. W. Fitzgibbon, resigned; Mr. W. H. Stocks has been appointed master mechanic of the Illinois division, with headquarters at Chicago, vice Mr. A. L. Studer, transferred; Mr. R. D. Fiddler has been appointed master mechanic of the Eastern Iowa division, with headquarters at Rock Island, vice Mr. W. H. Stocks, transferred.

Mr. E. G. Russell, superintendent of the Rome, Watertown & Ogdensburg, has been appointed superintendent of the Delaware, Lackawanna & Western at Hoboken, N. J., in place of Andrew Reasoner, resigned. Mr. Russell is a Canadian by birth and entered railroad service as a telegraph operator. He rose rapidly to the position of assistant general superintendent of the Minnesota & Northwestern, which he left to enter the service of the Illinois Central. In 1893 he became superintendent of the Rome, Watertown & Ogdensburg, which he has just left to accept the position on the Delaware, Lackawanna & Western.

Mr. William McIntosh has left the position of master mechanic of the Chicago & Northwestern at Winona, Minn., to accept that of superintendent of motive power of the Central Railroad of New Jersey, with headquarters at Jersey City, N. J., taking the place of Mr. C. A. Thompson, who becomes consulting engineer. It has always been a mystery to us why Mr. McIntosh was so long permitted to remain in a subordinate position, for his shops and his management of the men under him proved that he was capable of filling a higher position with credit. We are glad, however, to know that he has been called, even if the selection was long in coming.

Mr. Arthur G. Leonard, who was private secretary to Vice-President H. Walter Webb, of the New York Central, and after that gentleman's retirement from office identified with the motive department of the Central system, has been appointed assistant to the president of the Chicago Terminal Transfer Company. Mr. Leonard received a very useful and practical training in the office of Mr. Buchanan, superintendent of motive power of the New York Central, and Mr. Webb selected him for assistant owing to his wonderful grasp of details of railroad work. Mr. Leonard is the kind of man who will forge to the front, no matter what line of work he is in.

Mr. J. W. Fitzgibbon has left the position of assistant superintendent of motive power of the Chicago, Rock Island & Pacific at Horton, Kan., to accept the position of superintendent of motive power and rolling stock of the Delaware, Lackawanna & Western, a new position. Mr. Fitzgibbon has enjoyed exceptionally fine experience to fit him for the work of organizing a mechanical department that has been run on the principle of every division being a law into itself, concerning types, forms and patterns. He has also the peculiar fitness of having served his apprenticeship as machinist in the Scranton shops of the Delaware, Lackawanna & Western. He also fired and ran locomotives on the same road, before going West to grow up with the country.

In our search for railroad news, we have frequently to take information from daily papers that occasionally turns out to be erroneous. In our personal page of last month we quoted an item to the effect that F. W. Deibert had been appointed superintendent of motive power of the Buffalo, Rochester & Pittsburgh Railroad, in place of C. E. Turner, resigned. There was not a word of truth in that report, and its publication in the first place is one of the mysteries of newspaper item gathering. There is a certain class of idiots about some railroad shops and offices who like to put up a job on a reporter by telling him lies concerning things likely to be printed as items of news. These people deserve to be kicked out of the positions they hold that enable them to bear false witness to the injury of others.

The following changes have been made on the Erie: Mr. J. F. Maguire, superintendent of the Susquehanna division, has been appointed superintendent of the New York division, with office at Jersey City, N. J., vice Mr. M. W. Maguire, resigned; Mr. W. L. Derr, superintendent of the Delaware division, has been transferred to the Susquehanna division, with office at Elmira, N. Y., and is succeeded on the Delaware division by Mr. George A. Thompson, with headquarters at Port Jervis, N. Y.; Mr. W. H. Barrett, trainmaster of the Susquehanna division is appointed superintendent of the Rochester division at Rochester, N. Y., and Mr. George A. Heller becomes trainmaster of the Susquehanna division. The office of Superintendent F. B. Lincoln, of the Tioga division, will be removed from Elmira, N. Y., to Arnot, Pa.

Mr. Alexander Kearney has been appointed assistant to F. D. Casanave, general superintendent of motive power of the Pennsylvania Railroad, with headquarters at Altoona, Pa. Mr. Kearney began his railroad life as an apprentice in the Altoona machine shops, going through the various mechanical departments. After finishing his apprenticeship he was appointed assistant road foreman of engines on the Philadelphia division, and later he received the position of assistant engineer of motive power of the Philadelphia, Wilmington & Baltimore Railroad, his recent position being assistant engineer of motive power of the United Railroads of New Jersey. He has by hard and intelligent work earned the distinction of being a shrewd railroad man, possessing excellent organizing ability, which is reflected in the results of his work in his last position.

Mr. Ledyard Cathcart has been appointed assistant to Prof. F. R. Hutton, of the mechanical engineering department of Columbia College, New York. Mr. Cathcart is a graduate of the Naval Academy, his course ending in June, 1875. He was then sent to service in the navy and had considerable experience on different vessels in various parts of the world. He passed his examination to

the grade of past assistant engineer in December, 1884, and after becoming interested in a particular line of manufacture resigned from the navy to pursue the work of his choice in January, 1891. He received an appointment from Mr. William H. Webb, founder of Webb's Academy, as instructor in marine engineering in the spring of 1897, but on the breaking out of the war he volunteered and was appointed chief engineer June 10, 1898, with appointment to the Bureau of Steam Engineering at Washington. He was honorably discharged in October, 1898, and received his appointment as adjunct professor of mechanical engineering at Columbia University in February, 1899. He will begin duty in this position in October next.

EQUIPMENT NOTES.

It is rumored the New York Central will buy 6,000 more cars.

Boston & Maine Railroad are having fifty cars built by the Laconia Car Company.

Schoen Pressed Steel Company are building 1,000 cars for the Pennsylvania Railroad.

Duluth, South Shore & Atlantic Railway are having 400 cars built by Wells, French & Co.

Wisconsin Central Lines have placed an order for seventy-five cars with Haskell & Barker Company.

Michigan Peninsular Car Company are building 150 cars for the New England Gas & Coke Company.

Missouri Car & Foundry Company nave received an order for 500 cars from the Wabash Railroad.

Allison Manufacturing Company have received an order for fifty cars from the Westmoreland Coal Company.

Schenectady Locomotive Works are building sixteen six-wheel connected locomotives for the Northern Pacific.

The Chihuahua & Pacific Railroad have placed an order with the Ensign Manufacturing Company for fifteen flat cars.

Pittsburgh & Western Railway have placed an order for three consolidated locomotives with the Pittsburgh Locomotive Works.

Pittsburgh Locomotive & Car Works are going to build two six-wheel locomotives for the Chicago, Lake Shore & Eastern Railway.

Baltimore & Ohio Southwestern Railroad are having 300 cars built by American Foundry & Car Company, also five cars by Wells, French & Co.

Rogers Locomotive Company have received an order for four six-wheel connected locomotives from Louisville, Evansville & St. Louis Consolidated Railroad.

The Lake Shore & Michigan Southern have ordered 500 pressed steel cars from Schoen & Co., Pittsburgh, Pa. Quick delivery is desired, and it is expected that they will all be in use within two months.

Schenectady Locomotive Works have received orders to build two six-wheel connected locomotives for the Maine Central Railroad, ten consolidated locomotives for the Delaware & Hudson River Railroad; twelve locomotives for the Minneapolis & St. Louis Railroad.

Rogers Locomotive Company have just received an order for five ten-wheel passenger and fifteen ten-wheel freight locomotives from the Mobile & Ohio Railroad. They will be equipped with Latrobe tires, Coale safety valves and Nathan lubricators. The passenger locomotives will have Safety Car Heating & Lighting Company's system of steam heat.

Locomotive Engineers Watching Legislation.

The Executive Committee of the Brotherhood of Locomotive Engineers of New York State waited upon the Assembly Judiciary Committee one day last month to protest against the bill offered by Mr. Phillips, of New York, which provides that all railroad companies must employ two regularly licensed engineers to run a locomotive or steam engine, and making it a misdemeanor in failing to comply with the provisions of this act. It is safe to assert that the bill will die in the committee. A large delegation of the engineers also called on Governor Roosevelt, relative to pending legislation. As they left the chamber the Governor made the following comment to a legislator who was present:

"I would like you to look at the faces and figures of those men. There are very few bodies of men who visited me this year that equaled them in physical appearance."

A locomotive engineer is of necessity a man who has pushed his own way up in the world under long, continued and repeated trials. Nerve, hardihood, excellent judgment, sleepless vigilance, entire self-reliance, and yet capacity to obey instantly, are a pretty good combination of qualities in a man.

Steel Cars Not Easily Damaged.

The Pittsburgh *Post* says in a recent issue:

"One of the big 100,000-pound capacity cars of the Pittsburgh & Western, No. 4211, built by the Schoen Company, has arrived at Allegheny after having been rolled down an embankment with 85,000 pounds of limestone on board. With the exception of two broken truck boxes, the demolition of the brake gear and dumping fixtures and the slight caving in of the sides, the car is still intact and can be repaired at slight cost. Before going over the embankment the car stood the brunt of a collision, and the wooden cars next to it were reduced to kindling wood."

Losing a Coupler Pin.

'Twas in the winter, years ago, on the Delaware, Lackawanna & Western road, when steam often went back on us, and we had to stop and blow up, that Pat Murphy was on as extra brakeman with Bill Armstrong.

On this particular occasion, however, the steam was "O. K.," but the key nad worked out of the coupling pin that held the drawbar, and the pin had worked out. Pat was directed to go back and flag the next section, while the rest hunted for the pin.

When the second section stopped, they of course wanted to know what the matter was.

"Oi don't know exactly," said Pat, "but Oi think Misther Armstrong lost his stame pin, and the fireman is out saking (seeking) it."

Mr. A. J. Smith, general passenger and ticket agent of the Lake Shore & Michigan Southern at Cleveland, has sent out a very artistic calendar, which consists of a very good illustration of a mail-bag and an approaching mail-train under it, with a pretty view of one of the lakes seen at the side of this well-known road. The calendar will make a very attractive ornament to an office, and shows the months and days so clearly that they can be seen at considerable distance. Persons wishing this calendar should send 8 cents in postage to Mr. A. J. Smith.

One evening last month delegations of locomotive engineers from the New York division called on Mr. Edward F. Brooks, the general superintendent of the Philadelphia, Wilmington & Baltimore, and presented him with a very handsome set of engrossed resolutions expressing the high regard in which Mr. Brooks was held by the engineers who had formerly been under his charge. Mr. C. M. Divenny made the presentation.

If any railroad company is looking for first-class locomotive engineers the editor of Locomotive Engineering would be glad to recommend men who would be certain to prove satisfactory.

Sansom Bell Ringer.

The very simple form of bell ringer hereby shown was invented and patented by Mr. John D. Sansom, an engineer on the Toledo, Peoria & Western. Figs. 1 and 2 are sectional views of the apparatus. Fig. 3 is an elevation of the ringer showing the front thereof.

In the several figures *A* represents the cylinder of the ringer, which is secured by studs to the bracket *B* of the bell-frame or support. The cylinder *A* is bored out to form the recess *C*. At the lower end of the cylinder is left plenty of stock to form a heavy base *D*, which is provided with a tapering bore *E*, within which is seated a plug *F* to form a valve, and which conforms perfectly with the bore by grinding it into its seat by any of the well-known methods. The base of the cylinder is also provided with a depending threaded stud *G*, through which is drilled a channel *H*, forming a port which communicates with the interior of the cylinder from the outer air. The valve *F* is given a corresponding channel *I*, so that when the channel or passages are in line a direct communication from the source of steam or air supply to the cylinder results.

To provide for exhaust from the cylinder a passage-way or port *J* is drilled through the base *D*, and the valve *F* is given a corresponding passage *K*, which of necessity must be at an angle to the passage *I*, as will be hereinafter more fully understood.

The valve *F* is secured in its seat by a spring *L*, which is secured by suitable means to the cylinder, and which exerts a certain pressure upon the valve. The spring carries a lug on its free extremity, which rests in a central indentation in the valve. This gives a positive hold and a "good job." A vent-hole is drilled through the base and opens into the end of the tapering bore *E*, so that pressure cannot force the valve from its seat. The outer extremity of the valve is provided with an offset *M* to form a lever, and to this is pivoted the lower end of a valve-stem O, the upper extremity of which passes through a lip on the upper end of the cylinder. The stem is threaded and fitted with adjustable stops *P* and *Q*, as shown. A piston *a* is now fitted to the cylinder, and is also bored out, as shown. The usual packing-ring *b* surrounds the piston, and a cupped leather *b'* forms a perfectly tight joint, so that no air or steam can possibly pass.

The piston rod is provided with a ball on its lower extremity and simply rests on the bottom of the piston, while the upper extremity thereof is pivotally secured to the crank of the bell shaft.

The operation of the device may be readily understood from the following: When the bell hangs at rest the crank thereof occupies a position at one side of the center, and as the valve is in a position to allow the pressure to enter the cylinder uninterruptedly the piston rises, carrying with it the piston rod, carrying the bell to the proper position or as far as the piston will travel, and as the piston reaches this point the lug *e* thereof carries the valve stem upward, thus turning the valve a portion of a revolution, or sufficient to cut off the pressure to the cylinder and open the exhaust port. The bell then returning by gravity forces the rod and piston downward, thus exhausting the air through the passage or port *K* in the valve, and as the crank and piston rod pass the center at the lowest position the valve again opens and pressure is again admitted to the cylinder, so that the crank is carried upward on the opposite side, and so on.

The Sansom bell ringer has been put upon the market by Mr. M. C. Hammett, maker of the Richardson balanced valve.

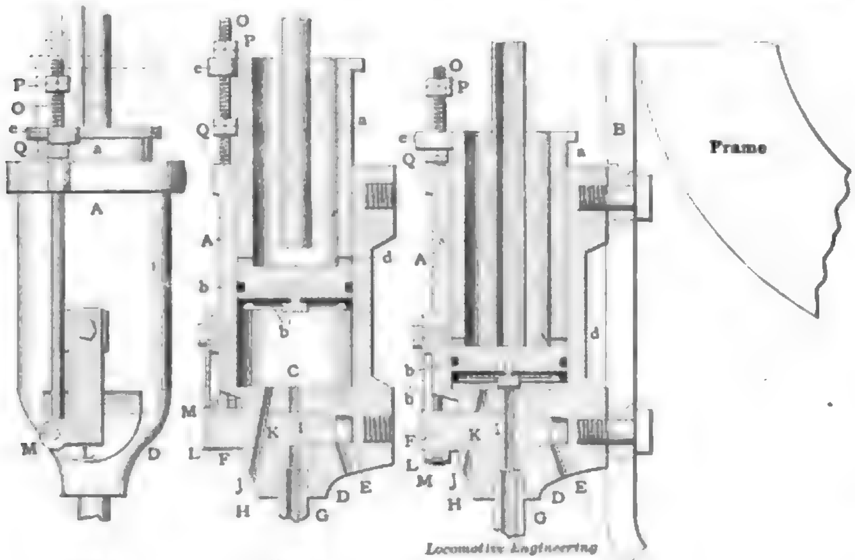


Fig. 3 Fig. 2 Fig. 1
EXHAUST POSITION RECEIVING POSITION
SANSOM BELL RINGER.

The Ideal Locomotive.

I will try and give you some data of the "Ideal" locomotive, which has been just turned out of the Baldwin Locomotive Works for the Inter-Colonial Railway of Canada. In many ways it has the appearance of a locomotive with ordinary pedigree. This one will fill a long-felt want. As it is constructed, there is no limit to its speed. It will pull as many cars up hill as down, with the same ease. This may appear wonderful to some that have not seen it, but this seeming paradox is easily explained after the principle is once fully understood. The secret of success is very simple, and consists of only a few parts, as follows: In place of the ordinary cylinders and steam chests there is a somewhat longer than ordinary length of sewer pipes used, one larger than the other. The top one is of the less diameter. The large one is used in place of cylinder, and has an opening near its middle with a bridge which does the business, as it has been proven that an opening without this bridge is of no use. There are openings at the ends of the pipes similar to those used in ordinary steam cylinders. The pistons are of the double type, the heads being about 2 feet apart. The smaller pipe contains something representing a piston valve, which is operated from the regular link motion. There are two exhaust pipes, one for the steam from the center of pipe, and one for what leaves at the ends of said pipes. The size of the exhaust pipes has no influence on the draft, which are merely used to convey away the steam after it has done its work.

With these slight changes the following results are obtained: There is absolutely no back pressure, no radiation, the exhaust steam reheating the walls of the pipes so the steam entering them is much stronger than when in the boiler, as it is so much more expansive from the heating. The amount of this reheating depends upon the particular shape of the central opening. It can be regulated to a nicety without getting it too hot for proper lubrication.

The notches in the reverse lever quadrant are seldom used, as the lever will stay at any point it is set without holding, on account of there being no friction whatever on the piston valves. This is so easily accomplished that it surprises many that it has not been done before. The only difference from other valves of this type is, the packing rings are made as thick as the recess in the valve, so there is no room for steam to get under them, and consequently no friction; this means no wear. How easy! The reheating of the walls is accomplished quite as cleverly. A portion of the exhaust steam at atmospheric pressure is allowed to pass through the peculiar opening in the center of the large sewer pipe into the end to be heated, and "Presto, change!" it is done. Just think how simple!

There is another valuable feature which may have been a "by-product," but should not be allowed to escape notice when one is filled with awe looking at the wonders of this engine. It is the leading wheels in front of these pipes which place it far enough in advance of the other wheels to give plenty of warning to the engineer and fireman, so they can pack up their things and be ready to get off after the leading wheel leaves the track before the others get to the obstruction. This shows the humanitarian part of the invention. It does not appear possible for any further improvement to be made in the locomotive, and I would advise inventors to turn their attention to some other field of thought, for the chances are many times in favor of discovering a new power to supersede steam than to make an improvement upon a machine that is perfect. Hoping this will interest others to some extent, the same as it has your most obedient servant, I am A. Scheumacher.

Philadelphia, Pa.

Roundhouse Chat—Pork vs. Oil.

BY R. E. MARKS.

"Say, Uncle Billy, I've got a scheme," said Jim Johnson. "'Spose you'll try to kill it 'cause it's new, but I 'blieve 'twould save oil to use grease in the cellars of the car axles. What in thunder are you grinning at, anyhow."

"Save oil 'cause you wouldn't use oil but grease—or save expense, which do you mean, Jim."

"Well save expense, if you're so darn particular—but what do you think of a scheme to use grease or some cheap stuff and keep it forced up against the bearing. Trouble with most of these schemes is that the stuff don't get to the axle. I'd take a bed spring and keep it there, having a pad under it, of 'course."

"Jimmie," said Uncle Billy, slowly, "did I ever tell you about the racket we had on the Syracuse & Binghamton road away back in 1858. Course I didn't, though, or you wouldn't spring this on me as a new game. Well, we had a hot time for awhile there, or rather a hard time.

"Clinton F. Page was superintendent then, and as he was always looking for improvements he listened to the tales of a man named McCollum, who used to be on the Erie. He had a great scheme for using pork in the boxes instead of waste. They oiled the top some, but the pork was in the bottom. In fact, the Erie used it for a couple of years.

"They made a light box to hold the chunk of pork and had a spring under it to hold the pork against the bearing. Looked some like the bed spring you spoke of. Well, they bought barrels of the nicest pork I ever saw and dissected it into the right shape. Then they put it in the boxes, hauling out the oily waste. Didn't have a hot box reported once, and Mr. Page thought it was great.

"There was a little grade from the depot down to the roundhouse and car yard, and Hank Beach, who ran the express (Jepson was conductor), used to cut loose and run down after leaving the cars at the station. Then the brakemen would let the cars down out of the way. Hank complained that the train pulled hard, but we all knew it was his imagination as well as the firemen's yarn about burning more wood than before. Pretty soon, though, the cars began to lag and would barely run down the grade themselves. Didn't need no brakeman—an unbrakeman would have been better.

"Next thing we knew, the cars had to be hauled down to the yard, and we came to the conclusion that Hank Beach wasn't such a lunkhead after all. We also learned that a bearing might run cool and still pull hard, something we hadn't thought of before.

"Well, they fired the pork then, went back to waste, and Hank Beach burned a cord less wood on the round trip. Better drop your grease scheme, Jim, that's been tried too, but there seems to be nothing like oil."

St. Petersburg-Vienna-Nizza Express.

A friend in Vienna, Austria, has kindly sent us the photograph from which the annexed half-tone was made, showing the St. Petersburg-Vienna-Nizza express going full speed up a 2½ per cent. grade near the Austrian frontier. The train consisted of one kitchen, one baggage, two sleeping and one dining car, pulled by a ten-wheel Golsdorf compound.

Weight of the train is 144 metric tons; weight of engine and tender, 107 metric tons. The schedule of the train is made for an older American type of engine, the Golsdorf compound being capable of pulling 200 metric tons at the same speed, about 32 American miles. The snapshot was taken by Master Car Builder Geyer.

EXPRESS TRAIN IN AUSTRIA.

Some railroad companies have adopted ball bearings for the center of their turntables, and reports say that the reduction of friction is so very great that one man can turn a heavy locomotive.

Signals to Engine Crew.

C. B. CONGER.

One of the duties of engine and train crews that is not systematic enough is passing signals to the engineer. If engineers appreciated how much they encourage the giving of misleading signals by taking them and then guessing at the next move to make, they would insist on having plain ones. If good plain signals are given and at once reach the man at the lever, throttle and brake valve, the work can be done enough quicker and safer to warrant some pains being taken to get them just right.

It is not unusual to hear trainmen remark that they can work fast with a certain engine crew, because they are always looking out for signals. Of course that counts some, but getting the signals so they are understood counts more.

With some methods of giving signals a good deal of judgment is required on the part of the engineer, for the same signal may be given to come ahead two car lengths as for ten times that distance. "Car Length" signals should be given, showing how far they want you to come when close to other cars, and "Full Arm" signals when you are expected to move some distance at a smart rate of speed and then steady up.

A common fault when switching with a number of cars, that are stopped with a few air brakes next the engine, is giving hard signals to stop, when an easy one can be given in plenty of time to take the slack out of the train and stop without so much shock to draft gear and lading in the rear cars. If the blame of broken draft rigging in cases where a hard signal to stop is given by trainmen was put where it belongs it would break up this practice instantly. No engineer can take chances on a signal to stop. He does not know how urgent the case is and must obey it literally.

When the signals are given on the engineer's side, it is fair to suppose that there is nothing said by either man, and that the fireman, in case he sees the engineer is getting all the signals from one direction, should fix his own attention the other way, to be sure that all switches are

set right and nothing is foul of the track they are going on.

Then when we go into the wider field of looking for signals when the complete train is running, the duties of each man should be very sharply defined. The engineer is supposed to be on the lookout for signals all the time; but in many places on account of the curves he cannot see them till too late. It is then the fireman's duty to look out where he can catch the first sight of signals, whether semaphore, station order boards, or switch signals, and call out to his partner the position of signal, whether "Clear" or "Stop"; order board "Set against you," or "Clear," so that the engineer will see the signals through the fireman's eyes, so to speak.

Some engineers require the fireman to call out the position of the order board as soon as they see it, even if it is in plain view of the engineer. This plan puts two men on watch for it. Others would resent this notice from a fireman as an indication that they had not seen the signal. It is a safe plan, just the same, to have the fireman look out for order boards also.

On trains that are liable to break in two, the man on whose side the curve is favorable should look out regularly to see if the hind end is coming, and so report to the other man on the engine. While a good many head brakemen riding on engines will rebel against it, yet we think it his duty to keep a close watch on fireman's side for signals, especially for the hind end, and be held responsible for knowing whether the whole train is coming.

Observance of signals should be literal; to be safe they should be intelligible.

Along the Missouri, Kansas & Texas.

The Missouri, Kansas & Texas Railway Company have got their new car shops at Sedalia, Mo., about finished. They are doing some work in them now. Most all of the machinery is new and up-to-date. They will have a capacity of at least fifteen box-cars a day, besides other repair work needed in the freight equipment. There is a wood-working shop two stories high, 80 x 160 feet; a blacksmith shop 60 x 120 feet; a machine shop 60 x 80 feet. The freight car shop has twelve tracks, each holding two cars. Any one of these tracks can be reached from either end. The coach shop holds twelve coaches at one time, besides stock rooms, etc., under the same roof. The coach shop and car shop open right out on the transfer table, which is 725 feet long and 80 feet wide, and it has connections direct with nearly every track in the yard. This table is operated by electricity; the shops are lighted throughout by the same power. There are a number of convenient kinks in the arrangement of the tracks and buildings. One of these consists in passing the old cars coming in for a rebuild to the car shop right in front of the boiler room, where they are stripped down of broken parts where this process will not cumber up the shop. These shops employ about 325 men. All the coach cleaning and repair tracks are there; so the whole business can be under one executive head. Mr. J. L. Wigton, master car builder, has his office at the shop. He is very proud of the outfit. It represents an outlay of over $140,000, part of which was contributed by the citizens in a donation of land for a location.

The locomotive shops of the Missouri, Kansas & Texas Railway at Parsons, Kansas, are working full time, and in addition to the engines now in service expect ten freight engines, 19 x 26-inch cylinders, moguls, to weigh about 124,000 pounds; and five passenger ten-wheelers, to weigh 138,000 pounds, with 20 x 26-inch cylinders. Superintendent of Maintenance and Equipment William O. Herin was East looking after this equipment at the time of our visit.

Master Mechanic Brehm, of the Missouri, Kansas & Texas Railway, at Parsons, is using a hub plate of vulcanized rubber on the trailing wheels of their Columbia type of engines with very good results. They give better service than brass plates, being fastened to the wheel hubs in the same manner as brass plates.

The air-brake equipment repair room at Parsons is well stocked with devices for testing both old and repaired triple valves, governors, brake valves, etc., which will be fully described in a future number of LOCOMOTIVE ENGINEERING.

An important feature of the equipment of the Hoosac tunnel elevator recently completed at Charlestown, Mass., for the Fitchburg Railroad Company, is the rubber belting which is used as carriers for the grain in the various galleries, and to which the buckets are attached for lifting the grain to the large storage bins. The contractor for the elevator, Mr. James L. Record, of Minneapolis, Minn., awarded the order for the belting to the Boston Belting Company, of Boston, Mass. It comprised about 7,500 feet of 36-inch four-ply, 1,600 feet 38-inch four-ply, and 4,800 feet of 22-inch six-ply, besides a quantity of narrower belts. The total weight of all the belts was upwards of 35 tons. The longest 36-inch four-ply belt measured 1,500 feet, and several others of the same width were more than 1,000 feet long each. Each of the 36-inch belts carries about 8,000 bushels of grain an hour.

The Falls Hollow Staybolt Company, of Cuyahoga Falls, Ohio, are in receipt of a large order from W. & A. Fletcher Company, of Hoboken, N. J., for safety hollow staybolts made from best quality of steel, to be used in a large Government contract. The Falls Company are in a position to fill orders promptly for their product, made of either steel or charcoal iron, and will guarantee perfect satisfaction.

A Kipling Poem.

Several years ago Mr. Fred D. Underwood, now general manager of the Baltimore & Ohio Railroad, named two stations in the upper peninsula of Michigan "Rudyard" and "Kipling," one being in an agricultural country and the other in an iron ore district. Some time later a mutual friend informed Kipling of Mr. Underwood's action, and the celebrated author sent Mr. Underwood his photograph with the following lines on the back:

"RUDYARD" AND "KIPLING."

"Wise is the child who knows his sire,"
The ancient proverb ran;
But wiser far the man who knows
How, where and when his offspring grows,
For who the mischief would suppose
I've sons in Michigan.

Yet am I saved from midnight ills,
That warp the soul of man;
They do not make me walk the floor,
Nor hammer at the doctor's door.
They deal in wheat and iron ore,
My sons in Michigan.

Oh, tourist in the Pullman car
(By Cook's or Raymond's plan)
Forgive a parent's partial view;
But, maybe, you have children too—
So let me introduce to you
My sons in Michigan.

RUDYARD KIPLING.

We received the poem and the notice about it from the advertising department of the Baltimore & Ohio, and it is a good illustration of the journalistic faculty which some men have to make the best of anything that turns up that is likely to advertise his paper or business. The Soo Line might have made a good advertisement of that poem when it was first written, but the advertising department missed the point. It remained for the keenest-scented man in the business, Mr. J. H. Maddy, of the Baltimore & Ohio, to turn it to advantage as an advertisement of the fact that Mr. Underwood is now general manager of the Baltimore & Ohio.

Two Large Locomotives.

The Illinois Central Railroad Company have contracted with the Brooks Works and the Rogers Works each to build a very large consolidation freight engine to be used between Carbondale, Ill., and Fulton, Ky., across the Ohio River Bridge. There is a grade of 40 feet to the mile and a 5-degree curve on the approach to the bridge. These engines are intended to draw 2,000 tons in addition to their own weight.

None of the details have been finally settled on as to the dimensions or type of boiler or number of drivers, size of driving wheels or cylinders. They will probably be 23 x 30-inch cylinders; weight of engine, about 215,000 pounds; weight of tender, 114,000 pounds.

Probably the Brooks will have a Belpaire boiler, 80-inch shell, and the Rogers a radial stay, wagon top; both to carry 200 pounds of steam.

The tenders have a capacity of 6,000 gallons of water and 10 tons of coal.

These engines are very near as large as the Union Railway consolidations, the largest in the world. They are to be built to do a certain amount of work, so that the dimensions of wheel and cylinder, arrangement of drivers, etc., are yet largely at the discretion of the builders, each of whom will no doubt strive to produce a type which they deem possesses special advantages.

When they get to work next August, LOCOMOTIVE ENGINEERING will have something to say as to their success.

The Echols Tap.

The new catalogue of the Pratt & Whitney Company, Hartford, Conn., gives a good idea of this new tap, which appears to have advantages over the ordinary style for many classes of work.

The peculiarity of this tap is that every other tooth is removed from each "land" or toothed portion of the tap, but in the following section the alternate teeth are left so that the blank spaces left by one set of teeth are cut by the next set. In other words, with a four-flute tap, only two of them, the opposite ones, are cutting the same threads.

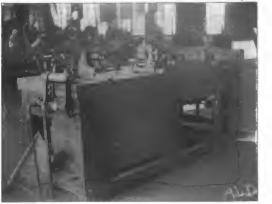
This gives a much greater clearance between the remaining teeth, and it is claimed that the result is to obviate the tendency to tear the threads. This gives a clear cut thread and also consumes much less power than the other way, owing to reduced friction. Their catalogue shows other new tools, but this seems to be one most likely to be new to our readers. We believe the catalogues are sent on request.

Railroad life brings out almost as many heroes as the battlefield, and they should not be forgotten either. John F. Dickson was operator at Peters, just below Edwardsville, Ill., on the Clover Leaf Railroad. He was struck by an express while going to deliver an order. After regaining consciousness, and though badly injured, he dragged himself back to his office to wire Charleston to hold a train that would have collided with another, had it left the yard. With the aid of his brother, who held him up to the key, he sent the message and fainted—having saved a bad wreck by his great pluck.

The Standard Coupler Company have removed their New York office from the Havemeyer Building, 26 Cortlandt street, to room 18, fourth floor, 160 Broadway. Railroad officials and other correspondents of the company are requested to make note of this change of address.

Air Tools in the Copper Shop.

At the Meadville shops of the Erie road there is a cunning little idea worked up for punching and shearing material used in the copper shop. Our camera refused to perform, but we were helped out by a young local amateur, Master Alton Dowdell, who kindly put his instrument at work and forwarded the picture to us from which our half-tone was made. It shows a cast-iron bench, having at the left-hand end a small wire-bending machine for car seals, and at the other end a pair of long shears. Each one of these tools is operated by an air cylinder under the bench, which has suitable connections from its piston to the tools. The three-way cocks by which the cylinders are operated are shown at the respective ends of the bench. The tools shown on the bench between the punch and shear are a gang punch for punching rivet holes in jackets, with a constant pitch, and other tools for copper-shop use, the functions of which require speed and accuracy. All of these tools are made so as to connect up to the pistons of the air cylinders, and when not paraded for inspection or in use, are kept in the drawers shown under the bench. Master Mechanic Donahue thinks the exhibit is one of the finest in showing what air can do outside of the well-exploited lift devices.



AIR TOOLS IN COPPER SHOP.

Compartment Car Outrage in India.

The mechanical officials of every railway where compartment cars have been employed have labored for years to devise some means that would enable passengers to communicate with the trainmen; but they have met with no success, and never will. The only safe plan is free communication through the cars. Seldom a month passes that reports are not made of outrages perpetrated on passengers in the secluded compartment. The latest comes from India. A recent issue of the *Railway Times*, of India, says:

"Two ladies left Lucknow on the evening of the 28th inst. in a first-class ladies' carriage. Between Lucknow and Amansi the door swung open and a man burst in, whose face was smeared with mud and coal dust. He immediately flung with both hands a handful of kunka and coal dust into the face of one of the ladies and proceeded to beat her over the head with a stick. The lady was so blinded that for the moment she did not feel the blows, but as they descended harder she sprang up and grappled with the man. He then tried to push her out through the door, which had remained open, but was prevented by the other, who came to the rescue and dragged him back. The lady first attacked then struck him a blow over the head with his stick, which her sister had managed to wrench out of his hands. The man fought savagely, trying to poke out the eyes of the lady who had grappled with him and biting her hands, while he dealt the other a heavy blow in the face with his fist, knocking her backwards; but recovering herself she again went to her sister's assistance, who by this time had been thrown to the ground and was under the assailant, and dragged him off. It was not till the train was within a mile or two of Amansi station that the ruffian made off, taking with him a courier bag, and leaving the unfortunate ladies utterly exhausted. The lesson of the outrage clearly is to point the necessity for some better means of communication between the passengers and the guard than now exists. The plan of a handle or bell care-

fully put in some inaccessible part of the carriage, often enclosed in a glass case which must be broken before it can be reached, seems rather designed to prevent than to facilitate communication in case of emergency, is a mere mockery.

"We have had sufficient of these assaults to make the railway authorities seriously consider whether it is not time they did something to facilitate communication between passengers and the driver or guard. It will be seen from the above account that the assault might have terminated far more seriously than it did."

Does Muriatic Acid Produce Galvanic Action?

There is a question connected with brass bearings that are trimmed before being lined with white metal which will bear looking into.

A solution of muriatic acid and zinc is used in the process, and considerable of this acid is in the pores of the brass and solidly dried on there.

The question now comes up, Does this acid not cause an electrical action when the journal wears through the white bearing metal and comes in contact with the brass?

If the acid produces a bad effect, is it an advantage to cast the bearing metal on the brass without the use of acid? A good many brass bearings that have run hot show a film of pure copper on the surface next the journals. It is worth while inquiring why this is so; if it is on account of the way it is poured in the mold, or from an electrical action.

A Lubricating Abrasive.

One of the strangest combinations of materials which we know of was shown recently at the Franklin Institute. Carborundum, as is well known, is several times harder than emery and is a fast cutting abrasive. Graphite, on the other hand, is a splendid lubricant.

It is therefore rather surprising to learn that by treating carborundum electrically the silicon is removed and the remainder is pure graphite, claimed to be practically identical with the mineral product. This is also another step in producing by artificial means material which has always been supposed to be solely a natural product.

Messrs Lucas & Gliem, of Ridge avenue and Hamilton street, Philadelphia, have issued a very neat catalogue, which consists of blue-line prints showing the general features of their cold sawing machinery, and printed descriptions of them bound between them. It is a sort of novelty, and the machines appear to be of substantial design.

Plain Talks to the Boys.

C. B. CONGER.

WHY JOURNALS RUN HOT AFTER PACKING HAS BEEN STIRRED UP. WHAT IS LUBRICATION.

Someone asked at our last meeting why the tender always ran hot the next trip after the packing was punched up against the journal and oiled good? Well, that is easy. It is a kindergarten question on oiling an engine. But we are out for information, whether for the primary class or the high school.

The packing on top next the journal when it settles down generally gets a liberal coating of dust or sand, which works in around the journal where the dust guard ought to be. When you push this dirty, gritty packing up against the journal and put oil on it, you make a paste that is first class for promoting hot boxes. Next time you have that job to do don't do it that way. Unless you pack the truck box all over with fresh, clean packing that has been saturated with oil before it goes into the box, you should push the old packing down away from the journal and put clean oily packing over it, taking care not to get any old gritty stuff next the journal, also taking care to put a good allowance up next the dust guard opening, so that the sand will not work along the whole length of the journal. This method gives the journal a good oiling with clean oil where it is needed.

If the front part of the box is tight and the dust guard is not, every time the journal works back and forth, when running, it pumps air in and out of the box. What grit is in suspension in the air goes along and sticks to the top surface of the packing. Get good dust guards in the tender oil boxes. That will stop a lot of the trouble from hot bearings.

This matter does not get enough consideration. Great care is taken that the dust guards in coach equipment are kept in good order, while on some roads the tenders, which run as many miles at as high a rate of speed and with as great a load on each journal, have no dust guards at all, but just an opening in the back of the oil box large enough to take in any size journal.

"Why do not the engine truck journals bother on this account; they have no dust guards at all?" you say. That is a fact, but the engine truck is up ahead of the rest of the engine, running through clean air with no dust, while the tender is in a cloud of dust that is raised as the ashpan passes along. How is it with the engine truck on a double header, or when backing up, so the truck gets a good dose of grit? You have doubtless noticed the fact that when you struck a pile of sand that the track men had left, or some dirt on a crossing, that a hot engine truck was next in order. You have also noticed that the back engine truck brasses wear out faster

and get hot oftener than the front ones, and ordinarily require more oil? That is because they get more grit. If the tender journals had as much oil per engine-mile and as good care in packing as the engine truck, very likely they would never run hot. The collar and shoulder on a tender journal are protected from the dust, while the bearing surface of the engine truck wheel hub cannot be protected and requires as much oil as a journal. Then the engine truck journal is oiled from the top with clean oil as well as from the bottom with packing. It is an open question on a dusty road if the packing in the collar adds anything to the lubrication. It only serves as a sort of guard to keep away part of the dust.

"How do you define lubrication?" you say? The object of lubrication is to keep a film of oil between the bearing and the journal that will hold the two rubbing surfaces apart and interpose a substance whose particles are easily moved on each other. Good oil does this to perfection. Is that the way you understand it?

Compounds on Northern Pacific—Long Piston Stroke.

At the meeting of the Western Railway Club at Chicago, on March 21st, the principal subject of discussion was a paper by Mr. E. M. Herr on "Compound Locomotives on the Northern Pacific Railway." This paper was very complete, giving the details of relative economy as to fuel, repairs and work done by the various classes of compounds in use on that road. During the discussion Mr. J. N. Barr, of the Chicago, Milwaukee & St. Paul, as well as Mr. Manchester, of the same line, gave figures and statements showing that the compounds were a success, both as to amount of work done and cost of operation and maintenance. The idea that the compounds were only good for hauling heavy trains of freight at a moderate speed was denied, as they have done some of the best service with exceptionally fast trains.

On the Vauclain compounds the wear of crosshead and guides needed the closest attention, so that there should be no lost motion. The later engines have much larger wearing surfaces than those first built. Mr. R. H. Soule said that these engines were being improved in design and construction as fast as any weak parts showed up, so that their service was being bettered every month.

Mr. Robert Miller, of the Michigan Central, said that their company was a pioneer in the use of compounds, the first Schenectady compound ever built having been built for and since used on their line. His experience and observation was in favor of compounds. The discussion was participated in by Mr. W. H. Marshall, of the Chicago & Northwestern Railway; Professor Smart, of Purdue University; Mr. Clement E. Street, Mr. L. R. Pomeroy and others, at considerable length.

The matter of a longer piston stroke for locomotives came up during the discussion of Mr. Clement E. Street's paper on "High-Speed Passenger Locomotives." Some very able arguments were advanced for a longer stroke than 24 and 26 inches for these engines; it being stated that the cylinders and connections would weigh less and cost less to manufacture and maintain; counterbalancing would be easier; the inequalities of cut-off due to lost motion or springing of the valve gear would be a less per cent. of the total stroke, and thus give better distribution of the steam in a long cylinder than in a short one. Against this must be taken into consideration the higher piston speed made by the long-stroke engines, which larger wheels would help out.

There was a very large attendance. Both the papers called out many comments. The discussion, to be appreciated fully, should be read from the Club Report, as it was too long to give in full in these columns.

Taking Things Easy.

Jud Jackson was one of the best runners on the road. He had been a shoemaker originally, and hadn't started to fire till he was about thirty-five. Then he fired six years and got "set up." He was no mechanic, and couldn't repair his engine to save his soul, but he was a good careful runner and was given the best runs on this account. But he was a slow, methodical man, one of the kind that wouldn't start to move out of a burning building till his coat-tail commenced to sizzle, but would manage to get out all right.

One day Jud was put on a long excursion train with a fidgety conductor, and after using all his threats and entreaties to get Jud to "hustle" he finally got mad and reported him. He stated his grievance at length, and had three fits telling the master mechanic how he had tried to hurry Jud without effect. "Did you leave on time," asked the master mechanic. "Jest about, sir." "And get there on time?" "Yes sir, but—." "No buts about it," said the master mechanic. "If Jackson didn't hurry any and yet made running time with a fifteen-car train of wild excursionists, by gosh I wish we had more Jacksons. It's these 'hurry' men that get us into trouble. Guess I'll have to give him the mail train." And he did.

"Packing" is the name of a very prettily illustrated pamphlet recently issued by the Boston Belting Company. It contains illustrations and descriptions of packings, valves, gaskets, diaphragms and a lot of other things handled by the company. It will be found a very useful thing for any shop foreman to have on his desk.

A New Course in Railway Engineering.

The University of Illinois announces that a course in railway engineering will be added, and that work in this department may be begun at the opening of the next university year, i. e., September, 1899. At the March meeting of the Board of Trustees this course was authorized, and provisions made for the appointment of a specialist for this important work. Considerable work has already been accomplished by the department of mechanical engineering in this direction, and the supervision of the work will still remain with Professor L. P. Breckenridge, of the mechanical engineering department. The course of study as laid out follows the same lines as that of the regular course in mechanical engineering for the first three years. During the senior year specialization begins both in the designing room and laboratory. The course as outlined leads along the lines of work of the departments of motive power and machinery.

The most handsome calendar that we have ever seen has recently been sent out by the J. G. Brill Company, Philadelphia, Pa. It is a very large calendar and contains reproductions of many of the finest art pictures that we have ever examined. The pictures form quite an attractive gallery in themselves that would be an ornament to any house or office. Those who have any connection with the products of the Brill Company, and have not received the calendar, should apply for it, and we readily pledge our word they will agree that it is the finest thing of the kind they ever received.

American Brake Company Works.

The American Brake Company, which make the driver brakes furnished by the Westinghouse Company, are very busy and are working about 250 men. A very good sign is that about half of their orders are for brakes to be applied to engines now in service, which shows that railroads are getting money enough to put driver brakes on all their power. A great many engine truck brakes are being furnished, some for old engines and others for new ones.

Some of the heaviest driver brakes ever put up are being sent out with 16-inch cylinders and a total braking power of 150,000 pounds. They are now building brakes for engines with 206,000 pounds on drivers, and expect to soon go beyond that weight.

The old saying that "corporations have no souls," "The Child Study Monthly" says, is disproved by the action of the Chicago & Northwestern Railway. This corporation, at the instigation of Livingston Fargo, who raised the money to fence it, built a pavilion, some swings and a sand pile, and has actually given, rent free, for a term of years, a lot large enough for a playground for five thousand children. The playground is in the heart of the Polish quarter, in the city of Chicago, miles away from any of the parks, and will be under the supervision of the Northwestern University Settlement.

The Cincinnati, Hamilton & Dayton offers the greatest inducements of any line in the Central States for the location and operation of manufacturing plants and other industries requiring the best shipping facilities. Plenty of water, cheap fuel, low taxes and populous small towns of the better class, where workmen can find good homes and good schools for their children. Information and assistance in investigating these locations will be cheerfully furnished. Apply to D. G. Edwards, passenger traffic manager, Cincinnati, Ohio.

We recently examined in the Morse Building, New York, an improved form of railway car and office window, which we think is calculated to greatly increase the comfort of passengers, especially during warm weather. It is pivoted in the middle and swings on the center, one end making an opening inside the car and the other an opening outside. By a slight movement it can be regulated to admit the exact quantity of air required by the passengers. The inventor says that it will insure perfect ventilation and protection from wind, smoke and cinders. Persons wishing to obtain engravings of this invention or more particulars about it should apply to Mr. Heilprin, Morse Building, New York.

Jenkins Brothers, 71 Broad street, New York, makers of the famous valves, have recently issued a very attractive illustrated catalogue. The catalogue opens with "A Fair Offer," to the effect that if you will put a Jenkins Brothers' valve on the worst place you can find, where you cannot keep other valves tight, and if it is not perfectly tight, or does not hold steam, oils, acids, water, or other fluids longer than any other valve, you can return it and your money will be refunded. That is the spirit in which Jenkins Brothers do business. The purchasers may feel perfectly safe that they will be satisfied with the valves made by this firm.

"Your Chance Has Come" is the latest publication sent out by the International Correspondence Schools, of Scranton, Pa. It is devoted principally to telling about men who took the chance to get education through the Correspondence Schools and greatly benefited thereby. It contains a great many object-lessons worthy of consideration.

Nearly every mail brings us requests for information about books. The inquirers would nearly always have the facts they seek for if they carried our book of books in their pocket.

The Ajax Metal Company, of Philadelphia, Pa., that have attained celebrity for their Ajax metal bearings, began marketing Ajax tin eighteen years ago, which was used as one of the alloys of the Ajax bearing metal. The company have now discovered some peculiar features which they call United States tin, and a good point about it is that they can sell it at a lower price than the imported tin. They say it will make a much superior metal, sounder castings—more homogeneous in structure, richer in color, of greater strength, and better wearing metal in every way. Those who are interested in using good bearing metal that prevents the expense and annoyance of hot boxes would do well to put themselves in communication with the Ajax Metal Company. We feel assured they will find something to their advantage.

In a report to the State Department the United States Consul at Birmingham, England, quotes Alfred Palmer, an English civil engineer, as predicting that the introduction on the Midland Railroad of American locomotives is to result in the much-desired central self-coupling buffer and bogie system of rolling stock as used throughout the United States and Canada. "American locomotives," says Mr. Palmer, "by having an elastic wheel base, are safer on the rails at high speed than ours, being better able to adapt themselves to inequalities of line or surface; but since the material used by and the workmanship of our engineers cannot be excelled, we shall doubtless hear before very long of British firms receiving large orders from America for the 'Yankee' type of locomotive."

We are just in receipt of advices from the Newton Machine Tool Works with regard to the numerous orders just received, among which is one from the Brooks Locomotive Works for a duplex milling machine and a vertical milling machine. These are the largest tools used in any locomotive works in this country. They are also building a cold saw cutting-off machine for the steel department of the Otis Steel Company, and two of their steel foundry saws for the Standard Steel Works at Burnham, making four of this one particular type of tool which they have in their works. Would also say they are receiving numerous, both domestic and foreign, orders, and are rushed to their fullest capacity.

"How the 'Greyhounds' of the Burlington Beat the Rising Moon," by Will B. Hunter, is the title of a very artistically got out booklet of twenty pages. It treats principally of the efficiency of the express passenger service of the Burlington Route, and makes the story very interesting and attractive. The illustrations are numerous and very fine. We believe that anyone can get the booklet on application to the passenger department of the Chicago, Burlington & Quincy, at Chicago, Ill.

"Teachers' Note Book" is the latest publication sent out by the Jos. Dixon Crucible Company, of Jersey City, N. J. It does not have very much to say in the way of graphite, but it contains a great deal of useful information on a variety of subjects that teachers will be very much interested in. We should advise everyone who is engaged teaching the young idea how to shoot to send for this publication.

A syndicate of Richmond and Baltimore bankers, with J. Skelton Williams, president of Georgia & Alabama Railroad, at their head, have secured the control of the stock of the Florida Central & Peninsular Railroad Company. The intention is to consolidate with the Sea-Board Air Line and the Georgia & Alabama Railway.

The Lehigh Valley Railroad people are experimenting with nickel steel for boiler staybolts. The principal objection they have found to the material is that it is too hard to be threaded with ordinary screw dies.

The Ingersoll-Sergeant Drill Company, New York, are sending out a small pocket illustrated booklet showing a great variety of their drills at work. People interested in rock cutting or in air compressors will find this booklet a useful pocket companion.

The New York offices of the Buffalo Forge Company have been removed to 114 and 115 Taylor Building, 39 Cortlandt street, from 406 Havemeyer Building, 26 Cortlandt street.

North Wales, Pa., boasts a combination which is not often found—a tombstone foundry and a billiard room in the same shanty.

C. S. Burt & Co., New Orleans, writing to the Buffalo Forge Company say:

"Noticing some of the certificates sent you in regard to your blowers, we will give you a good one. We have been using in our work something over one hundred of your blowers, mostly of the largest sizes, each and every one of which has given entire satisfaction to our customers and to ourselves."

One of the earliest applications of the steam jet blower for locomotives was that of Gray & Chanter on the Liverpool & Manchester Railway, in 1837. There is some dispute as to the first use of this device, but this seems to be very close to it. The use of jet blowers did not become common until coal as fuel came into use.

CONTENTS.

INDEX TO ADVERTISEMENTS.

ABOUT L. W. POND

PLANERS,

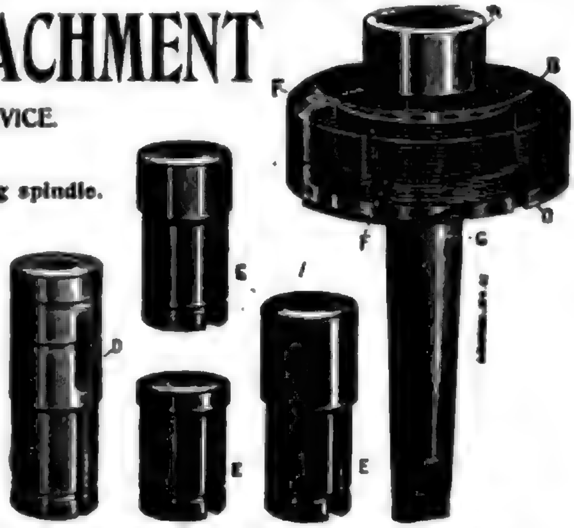
WORCESTER, MASS.

Railroad shops need a planer that is rigid, heavy enough not to spring under any cut, yet not clumsy to handle. It must work fast and keep at it. Broken or disabled planers don't earn any money. If you want one that meets all requirements SPECIFY the L. W. POND kind.

Shall we send circular describing it?

THE ONLY TAPPING ATTACHMENT

THAT HAS STOOD THE TEST OF TIME IN ACTUAL SERVICE.



Combines all that can be desired in such a tool.
Can be used in any machine having a revolving spindle.

IT IS SIMPLICITY SIMPLIFIED.

Nothing to break, nothing to wear out. Effects an ENORMOUS saving in TIME. Effects an ENORMOUS saving in LABOR. Effects an ENORMOUS saving in COST.

WORK DONE ACCURATELY, QUICKLY, WELL.
CAN YOU AFFORD TO BE WITHOUT IT?

Yours on trial if desired—at least inquire about it.

BEAMAN & SMITH, Providence, R. I.

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Any tapping device transmitting power through a friction of any kind is an infringement of our patents

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1898

BOUND VOLUMES

—OF—

Locomotive Engineering

are still to be had. Stock is diminishing fast though, so it won't do to wait too long. They make a complete record of last year's railroading—have lots of information on air brakes, compound locomotives, repairing locomotives and boilers, injectors and how to handle them, shop kinks by the dozen, besides lots of other points too numerous to mention. It makes the best book on general railroading that we know of.

Nicely bound in cloth, $3.00.

Locomotive Engineering,

95 LIBERTY STREET,
NEW YORK.

THE NEW EDITION OF *Locomotive Engine Running and Management.*

By ANGUS SINCLAIR,

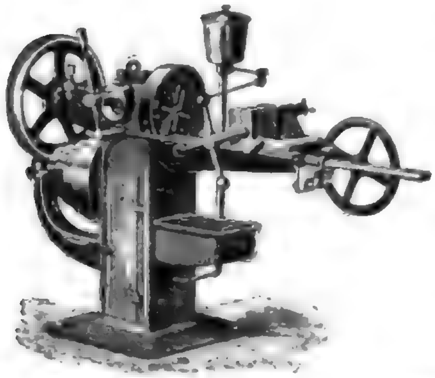
is just off the press and ready for delivery. Twenty previous editions look as though it was appreciated. This isn't merely a new edition from old plates. It has been revised and re-written and is practically a new book. Among the 24 chapters are:

- Inspection of Locomotives,
- Running Fast Freight,
- Getting Up the Hill,
- Hard Steaming Engines,
- Shortness of Water,
- Boiler and Fireboxes,
- Accidents to Valve Motion,
- Setting the Valves,
- Westinghouse Air Brake,
- Tractive Power and Train Resistance,
- Combustion,
- Sight Feed Lubricators,
- Examination of Firemen for Promotion.

Any engineer can get more than $2.00 worth out of these chapters alone, and even if he has a copy of the old edition it will pay him to know what is new in his field. Why not be the first on your division to get a copy?

Locomotive Engineering,

95 LIBERTY STREET,
NEW YORK.



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BOLT CUTTER

Cuts a clean full thread with one passage of the die.

Cheapest and best Die Work. Automatic.

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VISES, PULLEYS, HANGERS.

Made by Howard Iron Works,
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INFALLIBLE
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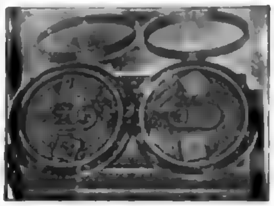
RAILROAD INVENTIONS A SPECIALTY.



AMERICAN BALANCE SLIDE VALVE.
BEVELED *RING EXPANDED ON A CONE.*
NO SPRINGS *SELF SUPPORTING. SELF ADJUSTING.*
ABSOLUTELY STEAM-TIGHT ALL THE TIME.
Used on 110 R. Rs. Glad to tell you more.
Write to American Balance Slide Valve Co., Jersey Shore, Pa.

THE ROBERT W. HUNT & CO.,
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71 Broadway, New York. Park Building, Pittsburgh.
Inspection of Steel Rails, Splice Bars, Railroad Cars, Wheels, Axles, etc. Chemical Laboratory—Analysis of Ores, Iron, Steel, Oils, Water, etc. Physical Laboratory—Test of Metals, Drop and Pulling Test of Couplers, Draw Bars, etc.
Efficiency Tests of Boilers, Engines and Locomotives.

THE COMPOUND SYSTEM. Air Compressing by compounding is economical in the use of steam and coal, at the same time reducing the temperature of the compressed air considerably.

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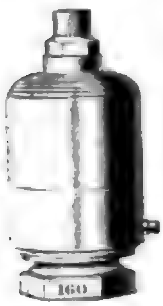

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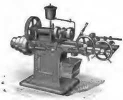

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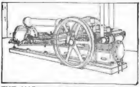

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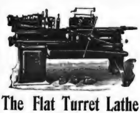

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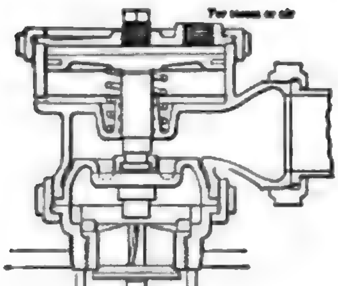

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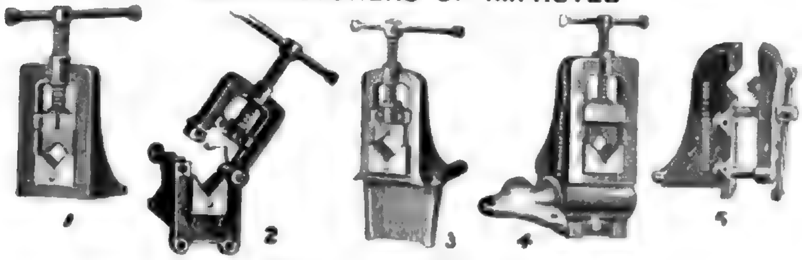

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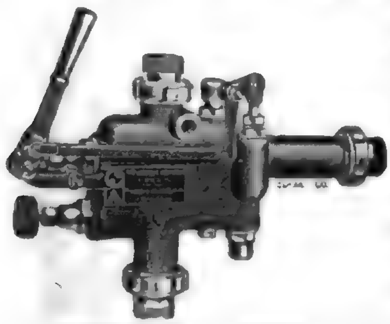

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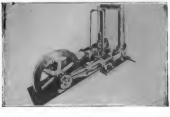

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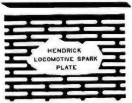

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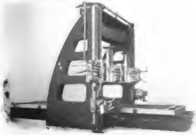

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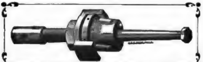

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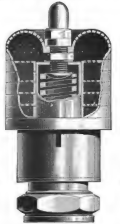

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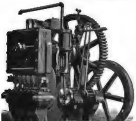

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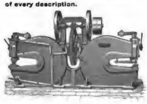

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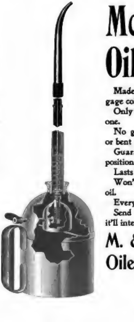

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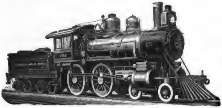

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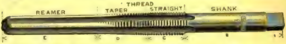

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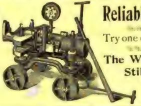

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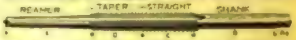

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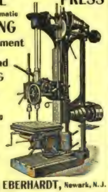

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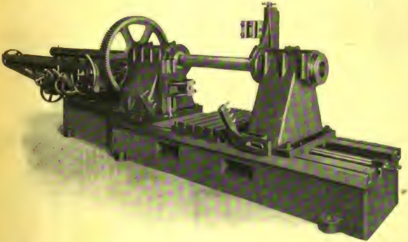

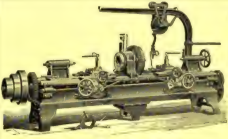


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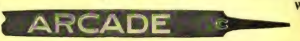
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LocomotiveEngineering

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XII | 95 Liberty Street, New York, May, 1899 | No. 5

Pittsburgh Engines for Japan.

The annexed engraving illustrates one of a group of narrow-gage eight-wheel compound locomotives built some time ago by the Pittsburgh Locomotive Works for the Kansei Railway of Japan. The engines have been at work for several months and are giving excellent satisfaction. The gage is 42 inches, and the engines weigh 82,000 pounds in working order, 52,000 of that being on the drivers. The engine has cylinders 17 and 25 x 24 inches, drivers 62 inches. Other particulars are:

Firebox crownstays, radial type—1 inch diameter.

Firebox staybolts, copper—1 1-16 inch diameter.

Tubes, material—Solid drawn brass.

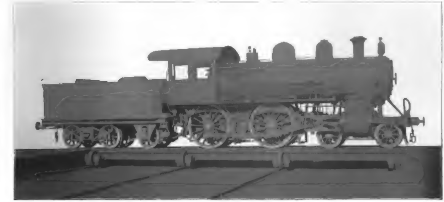
Number of tubes—228.

Diameter of tubes—1¾ inches.

Length of tubes over tube sheet—9 feet 4 inches.

Firebox material—copper.

Thickness of plate—Sides, 9-16 inch; crown, ½ inch; back, 9-16 inch; tube, ⅞ inch and 9-16 inch below tubes.



PITTSBURGH ENGINES FOR JAPAN.

Driving wheel-base of engine—7 feet 6 inches.

Total wheel-base of engine—20 feet.

Total wheel-base of engine and tender—38 feet 6 inches.

Height from rail to top of stack—12 feet.

Height of buffers from rail—2 feet 9 inches.

Distance from center to center of buffer—4 feet.

Slide valves—Richardson balance.

Piston rods—Steel, 3¼ inches diameter.

Type of boiler—Straight.

Diameter of boiler at smallest ring—54 inches.

Diameter of boiler at back head—56 inches.

Length of firebox, inside—66 inches.

Width of firebox, inside—29 inches.

Working pressure—180 pounds.

Grate surface—13.25 square feet.

Heating surface in tubes—963 square feet.

Heating surface in firebox—81 square feet.

Total heating surface—1,044 square feet.

Diameter of driving wheels, outside of tires—62 inches.

Diameter of driving wheels, centers—56 inches.

Diameter and length of journals—6½ x 7½ inches.

Diameter of truck wheels—33 inches.

Diameter and length of journals—4½ x 7½ inches.

Compressed Air.

The mechanical and engineering section of the Franklin Institute recently had a very interesting discussion on compressed air and its uses, which brought out many points not generally known.

In a brief but interesting manner, Mr. C. A. Saunders, of the Ingersoll-Sergeant Company, told of the uses of air since the time of Hero of Alexandria, and even before. Its use in the driving of tunnels, building bridges, mining, and the Bessemer process of steel making forms but a small part of the list; one novel application being the blowing of some ballast under the ties, these being raised to allow the stones to bed themselves.

Mr. James Christie, of the Pencoyd Iron Works, spoke of the practical application to their work and to the loss of air from leakage more than from inefficient tools. This leakage is not easy to detect, as it cannot be readily seen, and it is so comfortable for the workman—particularly in hot weather—that he seldom reports it.

One instance mentioned was in the grinding room, where the dust was not only annoying, but injurious to the workman. To remedy this a small jet of air was directed on to the work near the

grinding point. This not only kept the dust away from the workman, but kept the work and wheel cool, enabling more work to be done, and the wheel glazed much less than before.

Mr. Aldcorn, of the Chicago Pneumatic Tool Company, followed, and gave an interesting talk in regard to the use of pneumatic hammers for various purposes. He described the use of these hammers for riveting up to 1-inch rivets, and cited cases where boilers carrying up to 160 pounds pressure had been riveted in this manner. Along the lake the shipbuilders are using these tools extensively, and saving from 35 to 40 per cent. over hand work.

As an instance of this, he stated that this meant from 1,000 to 1,500 flush rivets for a day's work, and that these were also chipped off flush by another hammer with a chisel, operated by the same man.

In cutting flues out of locomotive boilers, a man could cut out three a minute, and at the same time save from 3 to 4 inches of tube over the old way. It also leaves the tube in good shape for welding on the additional length required.

Beading flues is another point where these tools save money, 240 having been done in two hours in more than one shop. The use of these tools in overhauling an engine has been estimated by some master mechanics to save from $40 to $50 per engine, besides the saving in time out of service.

Mr. Pilling, of the Q & C Company, gave as his opinion that both piston and rotary motors had their field—the former in the shop, where they would have good care from skillful men; the latter for outdoor work and by less skilled mechanics. He made the rather amusing statement that you could run two piston drills from the exhaust of a rotary, but you could drop the rotary three stories, catch it on the bound and it would go to work again. This was simply to illustrate that both the consumption of air and the amount of repairs for any given work must be considered for best results.

He also spoke of the advantage of having dry air for tools, and stated that the exhaust should not be seen—seeing it indicated moisture in the air. Properly made receivers would largely avoid this he claimed, and advocated a vertical receiver—the larger the better, with the air from the compressor going in at the top, and air being taken out at the side, say 3 feet from the bottom. This would deposit the water and dirt, which could be drawn off at the bottom. A water-glass to indicate the height would also be of use. Keeping the water and dirt out of the tools would prolong their life and secure better results.

Mr. Walter Ferris gave some results of his experience with air lines and air tools, and showed that the leakage was more than generally supposed. In his case it varied from 10 to 20 per cent. in the line, not a tool or appliance being in use. He also showed that air compressors were not always economical, considered as steam engines, as his took 38 pounds of steam per horse-power of air.

The Golsdorf system of compound locomotive has been illustrated and described in the columns of LOCOMOTIVE ENGINEERING, but for those who have forgotten about details we would say that no intercepting valve is used, the compounding feature being controlled by the reverse lever. When the reverse lever is in full gear the engine works simple, and when the links are raised a certain distance, the engine works compound. The mechanism is very simple, and we have been surprised that the engine has excited so little attention in the United States.

We sometimes receive letters that are curiously addressed. Several times the S. P. has received letters from abroad with merely the name and United States as address. Lately we received a letter addressed: "The Air-Brake News," 256 Broadway, New York. The Post Office people delivered the letter all right.

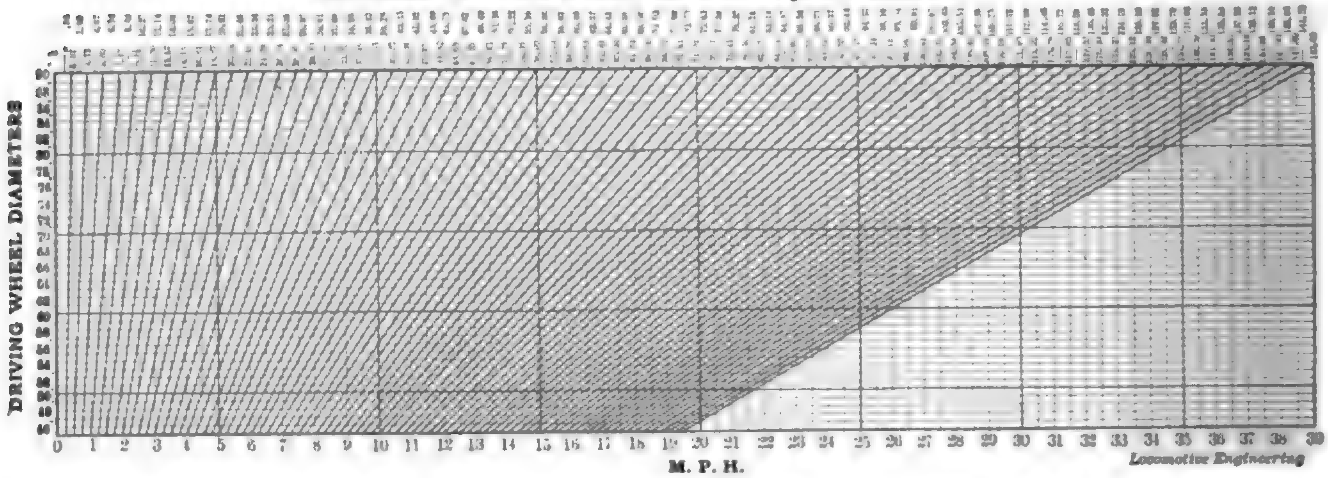
Diagram for Finding Speed of Trains.

BY JOSEPH P. ABELE.

Enclosed please find print of diagram which I thought might be of interest to some of your readers, and which I believe is original. It can be used for various purposes, among which I might mention, in conjunction with indicator cards, for which I made it more especially; but any one factor can be ascertained, the other two being given. I never bother with the decimals, but take the reading to the nearest whole number. This I find sufficiently accurate for all practical purposes. As you will notice, I carried the miles per hour up to but 39, but it will be readily seen that by a simple operation in mental arithmetic we can arrive at the number of revolutions per minute for any given speed rate. For instance, we have a 60-inch driver making 40 miles per hour. Find the revolutions per minute for 20 miles per hour, and multiply by 2, which would be practically 224 revolutions per minute. Then again, if the wheel is less than 45 inches, simply find the revolutions per minute for some diameter given on the diagram and multiply by the ratio which the larger diameter bears to the smaller. I find that 2 is a very convenient one and about covers everything. In this way the size of the diagram is greatly reduced, which makes it much more handy. The revolutions per minute are found by following the slant line, which is cut by the intersection of the two lines representing the required diameter and speed rate. This diagram has proven very handy to me, not to speak of time it saves.

Baldwin Locomotive Works,
Philadelphia Pa.

DIAGRAM GIVING REVOLUTIONS PER MINUTE FOR VARYING DRIVING WHEEL DIAMETERS AND SPEED RATES IN MILES PER HOUR BY JOS. B. ABELE.



[To make the diagram plainer to some readers we add some data. Miles per hour = 20, diameter drivers = 60 inches. Then to find the revolutions per minute find (20) at the bottom of the diagram—given as "M. H. P." Follow up this vertical until it meets the horizontal line representing diameter of driving wheels (in this case 60). This vertical 20 and

horizontal 60 intersect on a diagonal; follow up this diagonal to the top and read the revolutions per minute (112). If the revolutions for 40 miles per hour are desired find the revolutions for 20 miles per hour and multiply by 2 = 224. If for 60 miles per hour multiply by 3 = 336.—Ed.]

An Old Detroit Locomotive.

The engine, "Persian," illustrated herewith, was built by the Detroit Locomotive Works in 1854 for the Michigan Central Railroad. She was inside connected, with cylinders 16 x 20 inches, wheel centers, 63 inches in diameter, with the tire made a 5-foot 9-inch driving wheel. The firebox was 54 inches long, 35 inches wide, built as deep as possible, so as to burn wood successfully. The flues were of copper, 2½ inches in diameter, 160 in number. She was said to be a very fine steamer. The steam pressure carried, somewhere near 130 pounds, would be considered low in these days. The engine truck frame was of boiler plate, suspended below the truck boxes, called a "Sweet" truck. The side springs can be seen in the cut.

As usual in those days, lots of brass was used for ornament, which had to be kept polished like a mirror, and the whistle being located up ahead would throw water all over the dome at times. This class of engine weighed 62,630 pounds, and is very aptly described by an engineer who ran one of them. He said: "They were smart as a steel trap; were built upon honor, could run like lightning, pull a full train up a hill, and they rarely ever broke down on the road." The "Persian's" tender held 2,200 gallons of water, and three and a half cords of wood. The forward truck had center bearing springs; the rear truck had side springs. It will be noted that the brake shoe and head is in one piece of solid wood.

This engine was scrapped in 1876, probably on account of her crank axles. Another one of them, the "Rover," was in service in 1890 on the Chicago, Kalamazoo & Saginaw Railroad.

The picture from which this cut was made was taken in 1866. Master Mechanic Sweet is standing at the steam chest; Engineer Thomas Kent is in the window. The end of the baggage car shows the spring hood used in those days to keep cinders and smoke off the platforms.

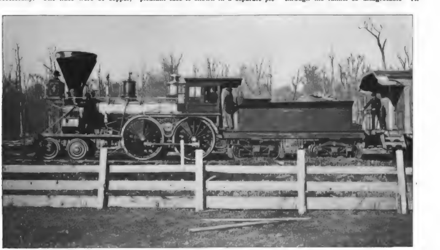
Her engineer, Thomas Kent, whose pleasant face is shown in a separate picture, entered the service of the company in April, 1854, was promoted as road engineer in 1860, and has never been under suspension or disciplined in any manner in his long term of service—a record of which he is very proud.

Engine "195," which shows the type of engine the Michigan Central Railroad Company build for their passenger service, was fixed up especially for him in recognition of his faithful services.

The cylinders are 18 x 24; drivers, 63 inches outside the tire; weight on drivers, 62,000 pounds; total weight of engine, 96,000 pounds.

The boiler is of the extended wagontop style, with radial stays, carrying 180 pounds of steam. It is 56 inches diameter at smallest ring; contains 207 flues; the firebox is 35 x 72 inches, with a heating surface of 136 square feet, the flues having 1,246.4 feet makes a total heating surface of 1,382.4. The Master Mechanics' Association type of front end draft appliances is used, and this engine is a very fine steamer. Her tender carries 3,500 gallons of water and seven tons of coal.

This engine was built at the Jackson shops, and embodies the best points of the successful engines on the Michigan Central Railroad, which are called on for very hard service on heavy trains, and not found wanting in speed and power.



THE "PERSIAN," A DETROIT-BUILT LOCOMOTIVE.

The Fitchburg Railroad Company have determined to install a huge electrically-operated fan in a shaft of the Hoosac tunnel for the purpose of drawing out the smoke and gas which make traveling through the tunnel so disagreeable Although the Hoosac tunnel is not by any means the longest in the world it has peculiarities which make it exceedingly difficult to ventilate. The fan will be driven by a 125 horse electric motor, the power being furnished by a neighboring electric plant. The engineering world will watch the progress of this work with keen interest. If it proves successful other tunnels will be relieved of their stifling fumes in the same way.

In some cities they are introducing compressed air and electrical apparatus to close outside shutters of buildings at closing-up time. We only wish that the practice had been well under way before the Home Life Building fire, in which our belongings met disaster, and that the iron shutters had been provided.

Converting Coal into Smoke.

In the course of a private letter written to this office by an engineer on the Chicago & Northwestern, a somewhat graphic account is given between the methods pursued by two firemen in performing the work necessary to keep the steam up on an express locomotive. Among other things he says:

"I have had an opportunity recently of studying the methods some firemen use in converting coal into smoke, and incidentally (from appearances I might say unintentionally) into steam. Let me mention notes of experience with two firemen on an express train of five cars; 85 miles; running time 1 hour and 50 minutes. The first man commences his work at the start as though his father owned the mine that supplied the coal, without seeming to reason why or how. With the wind behind, in 1 hour and 55 minutes he passed from the tank into the firebox 8,000 pounds of coal. She didn't make much steam. I suppose because she was too busy making smoke; but she got there on time.

"The following day I made the same run, same engine and train, wind, etc., conditions exactly as in previous day, with a different fireman. I suppose it was because I hadn't fully recovered from the excitement caused by witnessing the feat of the previous day that made me judge fireman No. 2 as indifferent. He put in lots of time at depot before leaving, smashing little chunks of coal that were already smaller than the door. Occasionally he put a shovelful on fire. Two minutes to leaving time and no black smoke! I got my delay blank out, filled in date and signed, all ready to hand in at terminal, with time lost and cause, 'No steam.'

"But we are off through the city; no smoke; out into the open country; fireman acts as though he didn't realize that we were running fast. Occasionally two more, often one shovel of coal passed quickly through the furnace door; no smoke yet; the gage pointer determinedly on the 190 figure; furnace door ajar; fireman watching a dangerous crossing half a mile ahead. No smoke. I look at steam gage. He has her nailed there. I feel the injector feed pipe; try the gage cocks. He notices my embarrassment and blows out the water glass; his movements directed by his brains adjusted to the circumstances. Terminal on time; same as day before. Coal consumed 4,500 pounds; net saving, 3,500 pounds."

Springfield Shops of the Kansas City, Fort Scott & Memphis Railway.

During a recent call at the Springfield shops of the Kansas City, Fort Scott & Memphis Railway we saw one of the neatest and most orderly set of shops, grounds and roundhouse it has ever been our good fortune to visit. They are in charge of Master Mechanic J. Bissett, who says, "The way to keep things neat and clean is not to let any man litter them up." We saw no one at work cleaning up in the ordinary sense of the term, because there was nothing to clean up, as every one seemed impressed with an idea that throwing any litter around was a very poor sign of a good workman. The employés are as proud of the tidy appearance of everything as are the officers. The engines, both in the cabs and outside, are models of care. While it is quite a task to get all hands into the way of doing this, yet in the long run it pays good returns on the time spent. Machinery that is always clean is better taken care of by those operating it. Shops that are orderly are more economical and capable of turning out more and better work.

About twenty-eight electric headlights are in regular service on the passenger engines on this line, and since the engine men and repair men have become familiar with the troubles incident to their operation and best means of remedy, they give very good service.

They have saved one or two disastrous wrecks, where cars have blown out on the main track and stopped in front of the night passenger trains. An oil-burning headlight would not have shown the cars in time to avert a serious smashup, with probable loss of life; the electric light did. Considerable trouble is caused by the heat from the arc breaking the headlight glass. This is in a measure obviated by setting the glass out from four to six inches further from the arc light. If a specially manufactured tempered glass could be used for this purpose it would help out. Changing the shape of glass is not a sure cure.

Importance of Punctuation.

Jim was "broke." However, he managed to reach Vancouver, and walking into the headquarters office of the Canadian Pacific said to the manager in charge, "I am Jim Wardner, and I am an old friend of Tom Shaughnessey. Will you please wire him and tell him I am here broke, and want transportation to Montreal?"

The manager, somewhat impressed with Wardner's peculiar presence and address, telegraphed Mr. Shaughnessey:

"Man named Jim Wardner, who says he is an old friend of yours, wants transportation to Montreal. Shall I give it to him?"

Back came the reply; "Don't let Jim walk."

Wardner at once obtained transportation, and left on the first train for the East. Arriving at Montreal, he called at the general offices of the company to see Mr. Shaughnessey, renew old acquaintance, and thank him for the favor granted. A number of prominent Canadian gentlemen were present when Mr. Wardner entered Mr. Shaughnessey's office with a hearty greeting of his old friend, which was as heartily returned.

"Hello, Tom; so glad to see you and thank you."

"Well, well Jim, is this really you?" Then, with the real Shaughnessey twinkle of the eye: "How under the heavens did you get here so soon, if you were broke?"

THOMAS KENT.

MICHIGAN CENTRAL LOCOMOTIVE.

"Why, Tom, thanks to your telegram, 'Don't let Jim walk,' of course I was at once furnished transportation; and here I am."

"Confound those operators!" he said, with apparent severity. "It is strange they cannot get my message through correctly."

"Didn't you telegraph 'Don't let Jim walk?'" interrupted Wardner.

"Certainly not. My answer was: *Don't! Let Jim walk!!!*"—*Anglo American Magazine.*

Adventures of an Engineer in Tropical America.

BY W. D. HOLLAND.

Differing from my customary reports of railroads, machinery and engines, this letter is going to give you a description of my Central and South American travels, the scenes of which come back to my memory as I sit by a cosy fireside in my Northern home. My adventures will be all the more interesting to those of your readers who know the countries between the Rio Grande in Mexico and the banks of the Rimac River in Peru, and who have stood on the stone bridges of Lima watching American railroads running along the river shores. They will visit with me the antique cathedral, the ancient place of worship of the Jukas, and gaze at the glass coffin containing the remains of that Spanish usurper and cut-throat, Pizarro, or see the natives kneel before the shrine of the Peruvian patron, Rosa of Lima.

One fine morning I was off from New York for Panama, and as the ship pulled out and the shores of God's country became more and more distant I wondered when I should see them again. The passengers around me waved the last farewell to their friends, and I was pacing the deck, gazing northward at the fast-fading city of New York.

That evening I became acquainted with a fellow passenger who asked me what my destination was, and I told him that I did not know myself; I might either go to Peru, Venezuela or to Guatemala, where a man could earn his bread by the sweat of his brow easier than in any other country I knew of.

We soon became friends, and after telling him that I was a machinist and engineer, he introduced himself as the Consul General of Salvador to New York, and offered to procure me a position in his country should I desire to accompany him. I thanked him and promised to make use of his kind offer in case I should not go farther South.

This was during the winter of 1893, and for the first three days out of New York it was chilling cold. Towards the fourth and fifth days, however, the atmosphere became quite tropical, and after a seven days' trip we landed one beautiful morning alongside of the wharf in Colon. Here my friend left me and boarded the train for Panama. I remained in Colon for a couple of days, and found this place one of the dirtiest and filthiest towns on the American continent, not even excepting New Orleans. Like most South American ports, it is reeking with fever and smallpox all the time. I visited the shops of the Panama Railroad Company, and also saw Mr. Mott, who has since met with an accidental death by drowning. He was master mechanic there at that time, and seemed to be doing excellent work. The shop was well equipped, and most of the engines looked neat and clean. The greater part of the engineers and mechanics were Americans, the switch engineers and all firemen being Jamaica negroes, the "sassiest" niggers that God ever put breath in. They were then paying mechanics $5 per day, and engineers were making $187 per month, but since that time wages have been cut. The company has 47 miles of road across the Isthmus of Panama, and also a small shop in Panama to do light repairs and to keep up the repairs of boats and barges used by this company in the bay of Panama. Mr. F. W. Johnstone, the well-known superintendent of motive power of the Mexican Central, was master mechanic at that point many years ago.

A few days in Colon sufficed me, and I left for Panama. It is a ride of about three hours, among tropical scenery, and now and then as one goes along, one catches a glimpse of the famous De Lesseps Canal, with all kinds of machinery imaginable lying wasted and half-buried in the sand. It was dark when I arrived in Panama, and the city certainly presented a fine view. From the piazza of the Marine Hotel (which had been recommended to me by the conductors) I looked upon the bay and the thousand lights reflected in the water. Panama has a 20-foot tide, and the tide was in—to a stranger from Colon it looked lovely. After dinner I took a walk around the town and the main plaza. The latter, with the cathedral and the Bishop's palace, looked something like home with its many cafés and saloons. I retired early, still unsettled which way to go, North or South. Panama to me resembles El Paso, Texas, in so far as from the latter place you can go by rail to California, Mexico, New

ON THE WESTERN RAILROAD OF GUATEMALA.

Orleans or Kansas City, while from Panama you can travel by water to San Francisco, Valparaiso, Chile, or to Mexico, Peru and Central America, and from Colon to Venezuela, New York, Hamburg, Southampton and Marseilles.

I awoke early in the morning and had the regular Spanish-American breakfast—coffee and rolls; that was all. Breakfast in these countries is at 11 A. M., and dinner at 7 P. M. I walked around all morning feeling a little homesick, as I had never been that far away from home before. Walking up to the shops, I hoped to find some old friend I used to work with before, but I recognized nobody, so I picked up an acquaintance with the boss boilermaker of the Panama road, Mike Moran. We spoke of mutual acquaintances and friends in New York, California, Laramie and the city of Mexico; and Mr. Moran being an old-time South American and formerly boss boilermaker in Peru on Meggs road, when it first started, advised me not to go down there, which I always regretted afterwards, when five years later I reached the land of the Jukas. However, as Mr. Moran was well posted on those countries, I took his advice and decided to follow my new friend from the steamer to Salvador and to work for him. I was gladly surprised to hear that the "City of New York" was going to sail in a few days, as on that vessel I made a trip from San Francisco to Guatemala a year before, and Captain Johnson and Chief Engineer Hirleigh were the most jovial companions I ever met. So the following morning I hired a boat and went to see them. They invited me for dinner and insisted upon my remaining on the vessel all night, which, however, I could not do; so after dinner I called the boatman to take me back to Panama, a distance of five miles. Had I known then what awaited me on the treacherous waters of Panama Bay that night I should never have left the good "City of New York."

THE MOLE AT SAN JOSE, GUATEMALA.

What is a Wompus.

BY HUGH SHARP.

The westbound was late last Thursday, and Tom Gentry was round oiling and losing no time about it either. I should like to have asked him a few questions about the new electric headlight, with its rotary engine myself, but there was an expression in Mr. Gentry's usually genial eye which suggested he had been asked just one question too many concerning it already between here and Fort Worth, so I restrained my curiosity.

Presently one of the natives strolled up—the sort of man that stops his subscription to the local paper if his name is not mentioned in it often enough to suit him.

"She gives a pretty good light, Tom?" he asked condescendingly.

"Tolerable, Colonel," replied Tom.

"How far can you see anything ahead on the track," asked the Colonel.

"Well, Colonel, that depends a good deal on what it is," replied the engineer, winking at the little crowd of loafers who had gathered as usual round the big Schenectady. "Guess we can see a wompus a quarter of a mile, can't we, Bill?"

Three-eighths of a mile would be nearer correct, Bill thought, if atmospheric conditions were favorable.

"Bill's right," continued Mr. Gentry; "'bout three-eighths of a mile for a wompus on a clear night."

"A wompus," said the Colonel. "What's a wompus?"

"A wompus," explained Tom Gentry, "is a black cat with a white"—

Just then "256" popped, and I lost the last word, which would doubtless have told just what a wompus was. The Colonel heard it though, and it seemed to rack him considerably. Now I feel a kind of curiosity to learn what a wompus is myself, but for some reason I hate the idea of asking anybody about it who I think knows.

The New Foundry of the General Electric Company.

We recently had the pleasure of being one of a party to inspect the new foundry of the General Electric Company at Schenectady, and incidentally to see as much of the rest of the plant as the limited time would permit. This rests on ground which was filled for several feet to bring it level with the rest of the plant, a total of 80,000 cubic yards of earth being used both inside and out. Specifications were sent out on March 3, 1898, and the first metal was poured January 5, 1899; quick work for a foundry with about 94,000 square feet of floor space, not counting the gallery at the cupolas.

The main building is 140 by 503 feet, with a large cleaning-room wing of 120 by 103 feet, and two smaller additions which contain the cupolas, heating and ventilating fans, washrooms, pattern room, etc. The side walls are 23 feet 9¾ inches high, while the main gable is 58 feet 3 inches. There are 1,200 tons of steel in the building, and though there seems to be little brickwork, still a million and a quarter bricks were used. There is more light than we ever saw in any foundry, the windows aggregating 12,236.6 square feet and the skylights 23,336 square feet. The sand sheds hold 6,000 tons; coke shed, 600 tons; so that quite a supply can be kept on hand.

The cupolas are of the Calliau type, having capacities of 7, 11 and 18 tons each per hour. One peculiarity is the use of screen doors at the charging holes in the gallery, which are actually kept cool by the air being drawn through them so rapidly. A Root blower furnishes 660,000 feet of air per hour at 95 turns.

The heating is done by the Buffalo Forge Company's system, one fan being located near each end and discharging the heated air from ducts aimed at different parts of the foundry. The air is drawn from the outside into the blower room, and a partial vacuum is created in there, as shown by the difficulty in opening the door outward and by the unceremonious haste with which you are assisted into the room, gripping your hat with one hand and warding off the door with the other. It ought to be a good training school for those going to cyclone sections of the country. Drawing the air from outside takes more heat than if it was drawn back from foundry, but the cold air gives a much better ventilation to the foundry.

Of course there are electric traveling cranes, seven of them ranging from 5 to

40 tons, and there are also three jib cranes of 5 tons capacity. Electric motors abound, twenty-seven of them counting up to 390 horse-power, and used for various purposes, from running the blower to the Sellers sand mixer and the coke conveyor. Arc lamps are also well supplied for night work, there being one for every 2,600 square feet.

The location of cupolas is such that small work is conveniently poured, the greatest distance to carry metal being 120 feet. The cleaning wing leaves the main floor clear for molding, and castings can be handled by the cranes from the main floor to the wings. In fact, everything is convenient for both the work and the men, and a large output is sure to result.

The large core oven doors move with surprising ease for such a weight, being mounted on ball bearings below and roller bearings above.

The small core ovens are about the neatest things we have seen in this line, as can be seen from the drawing which we reproduce. There is a car with a front and back which fill the opening and form a door in either position. Under this car is a pneumatic cylinder with the piston rod fastened to the wall at the rear of the oven. On the car are suitable shelves and racks for the cores.

After the car is filled, air is admitted to cylinder, and the car travels into place, the front forming the door to the oven. Admitting air to the other end of the cylinder forces the car out, and the back of car also closes the oven and prevents escape of heat.

This would not be complete without a reference to the courtesy of Messrs. Emmons, Rohrer, Webber, Pierson, Riddell and Mullen, as well as the electrically cooked dinner which awaited us.

Boiler Explosions and Low Water.

The cry of "low water" at every boiler explosion is one that has been handed down for half a century or more, but now seems to be meeting with the fate it deserves.

In looking over an old railroad journal we find an account of the explosion of the engine "Taghonic" of the Boston & Providence road in 1849. An elaborate inquiry was held, resulting in the verdict of "low water," although the evidence seems to show that there was water in the gage cocks when tried a little while before, and the crown sheet seems to have been in good condition, which would not be the case if it had been bare of water.

The cause of the whole thing seems to be due to a steam brake for the drivers, which acted much as the air brakes between the drivers did, but the brake cylinder was fastened direct to the boiler shell. This naturally put a heavy strain on the boiler shell, and was without doubt the cause of rupture. This is interesting both for the low water theory and the steam brake as early as 1849.

Plain Talks to The Boys.

BY C. B. CONGER.

Someone asked at the meeting in February about the openings through the sides of the firebox which admit air above the fire. It is a well known fact that it is impossible to get air enough through the grates and bed of fire to produce perfect combustion and change all the fuel into heat. In fact, there is a large percentage of fuel wasted because we cannot supply the exact amount of air needed at exactly the right point. If the draft is made severe enough to draw a large amount through the fire, in a great many cases it will overdo it, and it is now almost the universal practice to admit air above the fire at a place where it can be heated up to the igniting point and combine with the gases before they reach the flues.

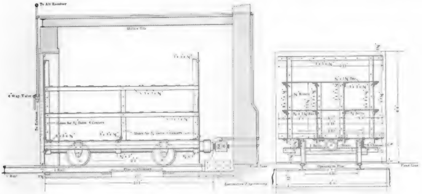
If these air openings are placed all around the firebox just above the top of the fire, as in the case of two or three rows of hollow staybolts, the streams of air coming in there will be so small and so close to the fire that they will be heated at once up to the burning point and aid in perfect combustion.

You will notice that all smoke-burning appliances have these openings; in some instances they are two inches in diameter. Some of them have a steam jet in addition, which induces a strong current of air over the fire. The steam jet is for use at a time when the exhaust is not strong. You can produce much the same effect by using the blower moderately and holding a scoop bottom side up in the door, so that the current of air coming in at the door will blow down on the fire. This will make a hotter fire at that point and clear away the smoke.

The quality of the coal has a good deal to do with the necessity for these air openings over the fire if you use them to prevent smoke. A coal that makes a heavy dense smoke needs more air above the fire than a coal that burns slower with less smoke.

The fireman who gets along with very little smoke, with an ordinary square firebox and no smoke-burning devices, has got the knack of building his fire of such a thickness that about the right amount of air comes up through it at all times; and this thickness varies to suit the way the engine is worked. This takes skill of the highest order.

"How will you learn how to do this?" you ask. Well, now, that question will take a longer answer than this chapter will



CORE OVEN CAR—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

allow. Observation of all the conditions of your fire will teach you a good deal, but you can't learn it all by yourself. Find out how the best firemen on your road do their work and try to do it that way yourself. Keep a close watch of the steam gage and your fire—never mind the stack—and you will catch on to some improved methods in short order.

Then you can get a good many pointers from instruction books on combustion. From the interest you appear to take in this matter there is no doubt you can soon learn a lot about it. In this great and progressive country there are so many means provided to "learn how" that no man has any reason for not knowing his own trade. Remember an excuse is not a reason.

"How about the brick arch?" you say. That used to be a matter of opinion on which there was an honest difference, but it is getting to be a matter of fact. Some men get excellent results without an arch, while another one cannot get along economically with the same engine on the same run unless there is an arch in her. In some cases it would make a difference of 15 per cent. in the coal consumed, in favor of the arch. There must be a reason for this. Very likely one man was skillful enough to get along without an arch, while the other man needed it to help him hold his record up where it should be.

Do not use this as an argument that a skillful fireman can get along without any help; he is just the man that can get the best service out of good devices. In the first place the arch gets so intensely hot that any air or gases above the fire on the way to the flues are heated to the burning point, and do burn and make heat, which otherwise they would not, as contact with the walls of the firebox would cool them below the burning point, which is a loss.

Then the brick arch causes the current of the fire and hot products of combustion to take a roundabout course from the surface of the fire to the flues. Every second they are held in the firebox gives another second for the water on the other side of the firebox sheets to absorb the heat and make steam. The heat produced by the fire must be equally distributed all over the box, instead of an intense heat at one point and a very moderate heat at several others. There is no doubt that with a poor draft into the firebox and an uneven draft out of it through the flues, we will have some parts of the box cooler than others; this makes a poor steamer. This is very easily proved when the flues stop up so there is more draft on one side than the other. She don't steam. We get the flues cleaned out, and the improvement is due as much to the better distribution of heat in the box as to the increased heating surface of a few flues. Another advantage of the arch is that it comes between the door and flues, so that the cold air drawing in at the door will not strike the flues direct and cool them off so that they will leak. With coal that clinkers bad an arch comes in the way of cleaning the fire. This makes the cleaning business difficult; but a good plan to avoid this trouble is to carry a clean fire. Some men on your line can do this; others ought to.

A homely illustration of the operation and value of a brick arch can be taken from the Welsbach mantle we use on our gas lights. This mantle covers the gas flame and gets intensely hot, so that the air and gas which passes through the small openings in its meshes are combined at a high temperature, and so perfectly consumed that an incandescent flame is the result. That this method makes more light with less gas can be proved by turning off the supply of gas so that the light begins to get dim, and then turning off the gas on one of the ordinary bat's-wing burners to the same amount; it will give very little light in comparison. Of course the Welsbach mantle requires a chimney to give it a strong draft to ensure success, which the bat's-wing flame does not have.

This emphasizes the fact that a good draft is of just as much importance as good coal and a skillful fireman. A good article of coal can be spread over the fire with all the ability of a master hand, but if the draft is not proper no good results come from it. A strong draft can be more easily taken care of than one that is weak. If the draft is too strong it can be choked off by the dampers or held back by the thick fire, but there is no such remedy at hand if it is not strong enough, except shaking the grates and keeping a very thin fire. Possibly because a stronger draft cures so many faults of the engine or man it is resorted to so often, and we see on the work book the statement "Engine does not cut her fire," or, "Exhaust too soft; have to shake her every mile to keep her grates open," or, "Engine burns a red fire; something wrong in the front end." All these difficulties are expected to be cured by a smaller exhaust tip or a more open arrangement in the front end. There is no hard and fast rule for making these changes to insure success. What helps one engine will not always benefit another of the same design. It is a question of "cut and try." With an extension front end it takes more trying to get just right than with the diamond stack, as many of us know to our sorrow.

"How about the smokeless firing? Can it be done on all roads? Let us hear from you about that."

Well, that is a pretty lively question just now; and the men who have seen it done day after day say that it is all right. Those who have never seen it done say it is not practicable, and advance a lot of fairly good arguments to prove their side of the case. I have seen it done.

There are so many different conditions to be taken into consideration that we will have to pass it this meeting and take it up next time. Smokeless firing is more a matter of skill on the part of the fireman than on the kind of coal or design of the engine. It also requires the close attention of the engineer, who has his part to look out for. Without the co-operation of all the men that have anything to do with the coal and the repairs on the engine, the fireman's skill will not be effective. That is the reason that when all the work of smokeless firing is put on a fireman it is a failure; his skill is of no use unless helped out by the engineer.

As to whether it pays in a country where coal is very cheap, that is a question to be figured out for that locality.

But smokeless firing has got quite a start, and we must recognize its importance. If it is not practicable on all roads, a fair trial will show what there is in it.

Sat on the Safety Valve.

A recent press dispatch told the public that Sebastian Mischler, engineer on a Columbus, Sandusky & Hocking train, attempted suicide at Sandusky in a novel manner. His engine had been run out of the roundhouse with a good head of steam and a hot fire under the boiler. He boarded it and then, walked out on the running board and climbed on top of the boiler. He placed a board over the safety valve and sat on it. An employé heard escaping steam. He saw Mischler's situation, and he realized what the engineer was trying to do. He hastily pulled the fire from under the boiler. Mischler, with an oath, said to his rescuer:

"Let her blow up and I will go with her."

It is said that Mischler attempted to take his life in this manner believing the railroad officers would never discover how the disaster occurred, and his father could then sue the company for damages.

At the Springfield, Mo., shops of the 'Frisco Line Superintendent of Machinery J. R. Groves is using a liner of vulcanized fiber on the engine truck boxes to take up the lateral wear. This liner is riveted to the box. There is some more friction than with a babbitt or brass liner, but not enough to cause any trouble. The fiber liners last longer than a brass liner. In April LOCOMOTIVE ENGINEERING it is stated that the Missouri, Kansas & Texas Railway is using vulcanized rubber for hub liners. This should be vulcanized fiber.

A patent has recently been granted for an arrangement which utilizes the flame in a locomotive headlight to illuminate the side lights. The improved headlight has a two-part reflector, the one part attached to the lamp frame being provided with side openings and conduits, laterally adjacent to the flame, the tubes registering with the burner and extending to the side lights. The latter are provided with a special reflector by which the illumination from the headlight is made to also do service in the side lights.

General Correspondence.

All letters in this Department must have name of author attached.

Questions About Schenectady Compounds.

The first Schenectady compounds that came here had vacuum valves on left steam chest, receiver, right steam chest, and one on each low-pressure cylinder-head. When these were all open the low-pressure cylinder did not run hot drifting down hill, and there was not much pull on the fire. But we soon found that as soon as the throttle was closed and the engine moving, even for a short stop, the walls of the low-pressure cylinder and piston head became almost frozen at once. On starting to use steam again, there was a vast amount of steam converted into water in warming these parts up again. This was a dead loss. The valves also, on the cylinder heads, picked up more or less dirt. At any rate, it was thought best to close them up—that is, the two on the cylinder heads. As soon as this was done, it was found, at speeds of over eighteen miles per hour, that the low-pressure cylinder ran hot drifting down hill, also that there was a heavy pull on the fire at the same time. Working steam through the throttle was tried, but it took so much to do any good that there was a loss in coal. Mr. P. Sheedy, the master mechanic at Los Angeles, experimenting to overcome this heating and drag on the fire, connected a 1¼-inch pipe to fountain in cab; valve in reach of engineer; carried pipe to cylinders on both sides of engine; made ¼-inch connection to each cylinder head with small check valve at each of the four connections. In drifting, steam is admitted to piston head or cylinder direct, allowing a small amount of steam to do as much good in this way as a large amount would do, *via* dry pipe past all the vacuum valves, receiver, steam chests, etc. The builders give the valve on the low side 3-16 inside clearance to overcome compression in low cylinder. After the pipe connection was put on the steam killed the air in the cylinder, also the compression, to so great an extent that it was found that in order to have compression enough to keep the main pin from heating on the low-pressure side, he (Mr. Sheedy) gave the valve 1-16 inside clearance in place of 3-16. Now he found the cylinder did not heat, there was less working on the fire in drifting.

The compounds that came last, having the new-style intercepting valve, in drifting down hill cut in compound; the intercepting valve keeps moving back and forth about an inch at each stroke of the low-pressure piston. This in time would ruin the valve cylinder. To overcome this the engine has to be cut in straight while drifting. There are a number of objections to this, one being the loss of air to hold the exhaust valve open, as the piston has snap rings, which are not air-tight, as you know. This could be overcome by connecting steam to pipe in cab in place of air. Another is the pound and slap of the rods when drifting cut in straight. There is a reason why this valve does this. Perhaps some of your readers who have run these engines can state why, and tell us how to overcome the movement without cutting them in straight. We know to open the throttle will stop it, if you open it wide enough; but then comes a loss of coal at $7.80 per ton.

C. R. PETRIE.

Los Angeles, Cal.

Smokeless Firing of Bituminous Coal.

I notice an article in the March issue, 1899, from B. V. Francis, Galeton, Pa., on "Smokeless Firing," which I endorse, and would add a little to it in the following:

The firemen are often treated in a way which has a tendency to drive them all in one direction, towards carelessness and indifference. To get co-operation from men in this condition is uphill business. I have had four or five as good firemen as ever polished the wooden end of a scoop, and it has been almost impossible to get them to try very hard to assist in economising when such efforts are not substantially appreciated.

To attain the result sought—smokeless firing—the fireman is not the only one who needs to change. Interest in the consumption of fuel on engines must commence with our officials in giving correct weight and coal that will yield the greatest number of heat-units, also a careful and correct performance sheet. A dishonest or incorrect sheet has the effect of promoting careless work. If the performance sheet is correct it will give credit where it belongs and show that efforts along the line of economy are noted. Then we will come to the engineer, as the other efforts will be of no avail if the runner uses poor judgment or want of care and does not study to make the best use of what is intrusted to his care. Poor management of a locomotive will disgust a good and careful fireman; for when he sees his studied efforts wasted, he will stop making them and commence to look for the end of the trip. Then comes our waste of fuel in roundhouses by careless fire-building. Again, upon the road there are many leaks to the fuel pile, such as indifferent switching and train-handling. If economy is to be found in the use of fuel, it must be by co-operation all along the line, from the officials to the man who knocks the fires out. I should like very much to hear from every engineer and fireman on this subject.

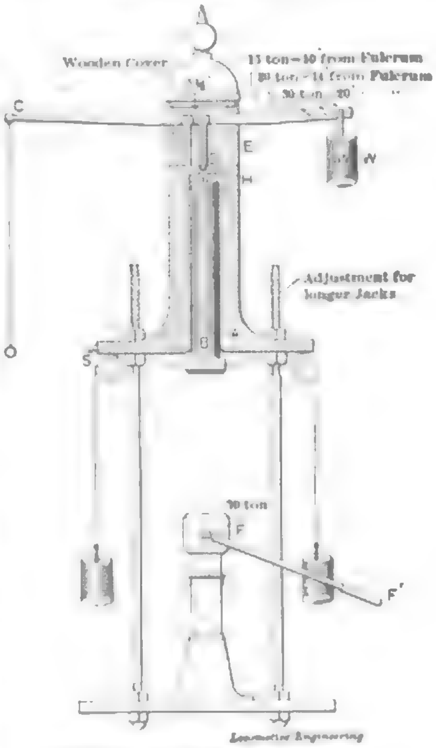
GEO. E. HOUTZ.

Tacoma, Wash.

[Our correspondent's views are the same as we have from time to time expressed. The officials who think they can bring about smokeless firing by an order issued to enginemen will be disappointed. Our experience has been that the officials are much more apathetic about fuel-saving than the enginemen.—Ed.]

Hydraulic Testing Apparatus.

The illustration represents a hydraulic testing apparatus, designed for testing hydraulic jacks after they have been repaired in the shop, and to ascertain if the jacks will be in good working order and in safe condition before they be put in use



HYDRAULIC TESTING APPARATUS.

under engines, cars, or sent away from home.

It will be seen the main features of it are the cylinder *A*, the ram *B*, the double lever arrangement with weight *W*, pointed steel stem *D* and the sheet iron reservoir *E*, which is partly filled with alcohol.

We will say we have a 30-ton jack *F* repaired, and now we have it in position to test it to its full capacity of 60,000 pounds.

We pull down lever *C* on the left side and hook it at *G*. This will raise weight *W* and lever on the right side, and also will

lift steel stem point *D* off its seat. The open ram *B* will now go down on its own accord and the alcohol in reservoir *E* will follow the ram *B* through the ⅛-inch hole *H* and will fill the empty space in cylinder whatever ram makes by its downward movement until it comes in contact with head *F*, where it stops.

Now we unhook at *G* and weight on right side will go down to its first place, and the pointed steel stem will cover the ⅛-inch hole or its seat and will confine the alcohol in cylinder for the present.

We are now ready to operate handle *F'*, and we pump up and we soon will compress alcohol in cylinder to 60,000 pounds. We pump up further until we have tested the whole length of the ram movement. You see in this way there will be no overpressure, for as the ram moves up the alcohol will gradually leak out of cylinder and back to its first place, the reservoir, and the same time the weight of 60,000 pounds is maintained on jack *F*. By testing in this way it soon will tell if there are any buck-shot holes or other defects in the packing leather, which are generally so nicely covered up by the polishing machine of the leather manufacturer.

J. A. Eisenacher.

Elmira, N. Y.

Noise of Exhaust When Engine is Drifting.

In reply to Mr. Geraghty's explanation to my question in January number of Locomotive Engineering in regard to engine exhausting while drifting, equipped with American balance valves, will say for further information, the exhausts are louder or more distinct when engine is moving from two to eight miles per hour. At this rate of speed I hardly think the compression would be great enough to lift valves off their seats. But if such be the case of valves floating in chest I think it would be more of a blow than a distinct exhaust, as I have stated. If Mr. Geraghty's theory is correct I don't see why this floating would not occur with the unbalanced valves as well, as it only seems to be a question of vacuum in steam chest on top of valve, and compression under valve, near each end of piston travel. If the valve floats this surely would reduce the compression and vacuum to nothing, as the piston would draw from one end of cylinder what was expelled from the other, and *vice versa*. I hardly think the theory of valves floating is correct, as it would destroy the vacuum in steam chests.

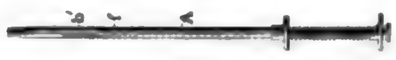
On the road I am connected with we run one pipe from air-pump exhaust to live steam ports, near cylinders, branching off under boiler; 1-inch pipe to each port, with intermediate check-valve located in each pipe, the other exhaust pipe branching off near pump and running over cab, connecting to a feed-water heater in tank. In this pipe over cab there is a cock opening to atmosphere to throw air-pump exhaust to same when engine is working steam, if water ever should get too warm in tank. When engine is drifting the check valves in pipes to live steam ports drop from seats, allowing air-pump exhaust to go into cylinders. Now, when drifting from twenty to forty miles per hour, by opening this cock on top of cab and placing your hand over it the vacuum is so great in steam chest drawing on it you would not care to let it remain there very long, and air-pump exhaust flowing to cylinders at same time. These conditions apply to all engines equipped with American or Richardson, balanced or unbalanced valves. I can see no difference. I hope Mr. Geraghty or some one of the many readers of Locomotive Engineering can give further information on this subject.

I. F. Wallace.

Sioux City, Ia.

Device for Lighting Headlights.

I see in your January and March numbers very good recipes for lighting a headlight. I enclose you cuts of an instrument which our high winds of Kansas caused a brother engineer, Hadley R. Rossetter, of



HEADLIGHT LIGHTER.

Emporia, to invent, which is worked by putting a match in slot *b'* of tube *A*, putting same down chimney, then pushing down on button, forcing match through contracted end of tube, causing match to ignite down in chimney, and no danger of it blowing out as the headlight door need only be open enough to admit arm. It is used by myself and several engineers on the Atchison, Topeka & Santa Fé Railway, and is very handy and convenient. It is also very handy for lighting markers or blizzard lamps.

W. T. Delano.

Newton, Kan.

Pressure on Slide Valve.

It is quite a common idea to consider the pressure on the back of an unbalanced slide valve to be the area of back of valve multiplied by the steam pressure per square inch. Another idea is, the pressure on a slide valve is equal to steam pressure per square inch on top of valve, less the area of steam ports.

Were we to consider the valve a solid piece of iron on a solid table, and absolutely a tight joint between valve and table, the steam would press on every square inch of surface with the same force a dead weight would. If such conditions are ever found, they are only when the valve covers both ports and engine is at rest. As soon as the valve is moved, the steam enters the open port; the pressure is practically taken off that end of valve; it is then moved back over the port, and the steam which is shut up in the cylinder presses up against the under side of the valve with a force equal to the pressure at point of cut-off. As the valve continues its stroke, the other port will be opened, and the steam which is shut up in the cylinder begins to exhaust. At this time the pressure against the under side of valve will be the pressure in the cylinder at the time the exhaust port opens. As the steam escapes very rapidly this pressure is only for a very short period.

During the time the steam is entering the open port, and after the exhaust has passed out and exhaust port closed, the pressure on the under side of valve will only be the ordinary back pressure on piston.

In order to determine the pressure on back of a slide valve, we must consider the pressure in cylinder at point of cut-off, mean effective pressure at point of release, area of ports, area of back of valve and the back pressure on piston.

A great many theories have been advanced as to the cause of the uneven wear of valve seat; but it is my opinion the main cause of this uneven wear is as I have stated above, to wit—as soon as the port is open and steam enters the cylinder, the pressure on valve at that end is released, while the full pressure is on the opposite end of valve and causes the valve to press heavily on seat at that end, and *vice versa*, thereby causing the valve to alternately wear each end of seat; hence the uneven wear of both valve and seat.

T. J. Henderson.

San Francisco.

Air Pumps, Etc.

Mr. Dunbar calls me to the "mast." Sea water does not get into the condenser to be handled by the air pump. The air pump does not handle the water for condensing; as you are quoting from Webster. The water for condensing is handled by the circulating pump. When I claimed that the air pump is a water pump to all intents and purposes I knew what I was talking about. When I claimed that a class of mechanics thought that the air pump of a marine engine was in reality an air pump, as we understand the term, they did not know what they were talking about. "The more waste, leaks and perfect the vacuum the larger the air pump required." I do not understand this last sentence. In quoting the crank shaft of the Hartford, I said a 5-inch hole; it is 6¼ inches. Shaft was made by the Bethlehem people. I do not know how the hole was made, but I do know it has a machined finish. His comparisons are not fair. No doubt but what the oil temper you quote is the factor of strength. Heating and oil tempering a 10,000 pound crank shaft is something yet to be done.

W. de Sanno.

Heating of Bearings.

I was interested in Mr. Conger's article on the effect of stirring up old waste in truck boxes or engine cellars. That sounds reasonable.

What I want to know is, why will a bearing so often heat when we take out waste and put in clean, and oiled her without regard to quantity. On the run it seemed as though every bearing got hot, and we laid the train out an hour and a half.

The branch took it with an old engine, not disturbing the bearings in any

SNOW-FIGHTING ON THE COLORADO MIDLAND.

all the old waste and put in fresh? I've seen this happen a number of times where it was especially annoying.

I remember one case, when we were to haul a special over the road to connect with a branch line. We fixed up our pet engine in great shape; took out all the way, and made up some of the time we had lost.

Perhaps it's because we are apt to pack the waste too tight in putting in new; but I'd like to hear what Mr. Conger has to say on the subject. I. B. Rich.

Honeybrook, Pa.

The Ton-Mile Per Hour.

The old-fashioned way of appraising the performance of a locomotive by giving its number of car miles per month was a most unsatisfactory method of procedure for several reasons. The principal objection to it was that all cars did not weigh a similar amount. If cars were unequal in weight, what could be said of the load each carried? An ardent apologist for the car-mile system might be brave enough to plead that the diversity in car weights is not so very marked, especially if broad averages only be required. When it comes to the loads carried, no amount of reckless courage would ever succeed in proving the hopeless proposition that four is equal to five, or both to eight. Yet, that four may, and generally does, equal five, is, "not to put too fine a point upon it," exactly what railway mathematicians have been writing on the blackboard for all and sundry, who had locomotive performance to compute.

The car-mile has been weighed in the balance and has been found to be most wofully wanting. It is inaccurate, and worse than that, it is unscientific.

The outcome of the desire for a more accurate and serviceable rating for engines has brought the ton-mile to the front as a measure of work done. This form of rating is much more to the purpose, but the difficulties in the way of its adoption have not yet all been cleared away. The step up the ladder, from the rickety car-mile to the more rigid ton-mile, is a step in the right direction. It has, however, been hampered to a certain extent by the desire to secure at one stride upward absolute accuracy. The variable effect of weather has been spoken of. The sky has been scanned for threatening storms, and we are sometimes told that unless we know the effect of wind on a train, the ton-mile bids fair to be as unsatisfactory as the car-mile has proved itself to be.

Difficulties in the way of the adoption of the ton-mile do exist, but they are not unsurmountable. Accurate weights of light cars and accurate weights of loads are essential to the correct use of this new nomenclature. If it be possible to get such exact figures (and it is possible if all work steadily toward that most desirable object), then it may be possible to make another fairly good ascent on the ladder of progress, and reckon with the weather in some sort of approximate way.

Curves and grades, on any division of any road, are a fixed quantity. They are neither more nor less at any time. Care should, however, be taken in comparing the performance of engines to set down east-bound trains as only comparable with east-bound trains, and west with west. An engine may more easily haul a larger gross tonnage south than she can pull north, or *vice versa*; due entirely to the configuration of the line. East-bound mileage may cost more coal than west-bound mileage, no matter what the weather may be. East-bound mileage over a curvy and

rocky division of a road may use up more fuel than that over the prairie division of the same road. It seems fair, then, to compute the performance of locomotives, first, over a definite division of a road, and these only which move in the same direction; for on any stated division, with known direction, the physical impediments to large ton mileage are equal.

Next come the variable weather, the kind of rail, and the exigencies of traffic. It has been said that dynamometer tests will furnish the only reliable data to go upon in this *terra incognita*. In the absence of such tests it seems to the writer that the ton-mile per hour may possibly lend some assistance in the calculation.

If a freight train of known weight starts east over the rocky and curvy division of the Try-for-Truth Railway she leaves at a certain time, which is noted accurately. She may encounter a heavy wind on the quarter on St. Valentine's day. That is known and is recorded, or will be, on this railway. She makes such and such time over the road to the fifth station. There she is side-tracked for fifteen minutes to let a local train cross her. The fifteen minutes is carefully noted by the train crew. She proceeds further a certain distance and arrives at a station where she is badly detained by another train. The standing time is again noted. She moves on only to be hopelessly side-tracked on a bad crossing with the "Limited." The delay is tabulated, however. So on to the end of the run. The conductor's, and perhaps the engine driver's, report for this train shows starting and arriving time from and at each of the termini. The railway company can then subtract the waiting time from the moving time, and so get the total time the train had taken to run over the road. This gives the time taken to move so many tons over the division, going east. The mechanical department has probably been able by experiments in the roundhouse to estimate the amount of coal burned by an engine while standing a given time. The completed report will show standing time and coal burned, and moving time and coal used. This, it will be remembered, was for February 14th, going east, with wind on the quarter, over the rocky and curvy division. It forms a record for these conditions and is set down for future use. Next day the wind resistance may be *nil*, and a different amount of coal be found as equivalent to the ton-mile east. This being repeated daily for a considerable period of time will form a record from which, by careful study, some interesting facts may possibly be learned.

With all this data before him the computer can reckon up the tons of coal burned per ton-mile per hour for days with similar wind resistance over this division in a known direction. This will give the basis for calculating the average cost of haulage per ton-weight in fair or foul weather, or with good or bad rail, at a certain speed. If the effects of weather so found be classified into, say, good, medium, and bad, the difference between the work on good days and that done on the medium and bad days will give in terms of coal burned, the effects of the conditions classified as medium and bad. With the total coal burned set down, the performance of an engine on good days, minus the standing still coal, will make the ton-mile per hour stand out clearly. The performance on medium and bad days subtracted from the average coal used in running on good days brings out again the ton-mile per hour with weather or rail effects disregarded, because approximately known and subtracted, not thrown in and ignored.

The importance of the "per hour" factor in the solution of the problem becomes very evident if one will look at the performance of two equal passenger trains running over the same division, in the same direction, on the same day, under similar conditions. One train, let us suppose, runs 120 miles in 3 hours, with a load of, say, 360 tons. That makes 43,200 ton-miles for the trip. The other train starts 20 minutes late, but "goes in" on time. She therefore runs the 120 miles in 2 hours and 40 minutes, and makes exactly the same total ton-miles for the trip. Now, the second train encounters an increased and self-created wind resistance and the engine burns more coal. The slower engine driver appears to be the more economical of the two, for he made ton-miles equal to the other on less coal. If both men keep this up, then at the end of the month the result is apparent. The coal consumption of one engine divided by the ton-miles made brings the quotient out smaller than that of the man who made up time all through month with equal ton-mileage. No. 1 burns less coal per ton-mile than his rival, but No. 1 engine has done less work. No. 2 has done more work, it is true; but it does not show, because his ton-miles equal those of the slower train. No. 2 is therefore higher in coal per ton-mile than his slower friend, but he has nothing to show why.

Some form of equation existing between work done and coal consumed seems here to be desired. If the ton-mile per hour be used, the case becomes simpler, and the statement fairer to each man.

No. 1, we saw, pulled 360 tons over 120 miles in 3 hours. He therefore makes 14,400 ton-miles per hour and burns x tons of coal. No. 2 pulls also 360 tons over the same mileage, but does it in 2 hours and 40 minutes. He makes 16,200 ton-miles per hour and burns $x + y$ tons of coal. At the end of the month, when the larger number of ton-miles per hour made by No. 2 is divided into his increased coal-pile figures, he may stand equal, or perhaps superior, to his fellow, and rightly, for his engine has done more work, and his cost per mile is certainly nearer the truth than before. No. 2, having done more work, may say with Shakespere, in Richard III, "Be assured we come to use our hands, and not our tongues." He deserves credit for work accomplished fairly, and the ton-mile per hour will give it to him.

George S. Hodgins.

Pilot With Drop Draw-Head.

In reference to cut of pilot with drop M. C. B. head, as designed by me and illustrated in the January number of the Locomotive Engineering, there is no patent, but it is free to all. Having this question put frequently, I take this means of informing your readers.

C. F. Thomas.

Alexandria, Va. Master Mechanic.

Draft Appliances—Third Paper.

FRONT ENDS.

We now come to that much-abused and oft-altered part of the engine, viz., the front end or smokebox. Here is where the draft is created and the changes made that cause her to "steam like a house afire," or "not make steam enough to ring the bell."

In adjusting the draft appliances in the front end, three factors are to be taken into consideration, viz., the exhaust nozzle, the diaphragm plate (in extension fronts, the draft pipe in short front end) and the stack.

In order to obtain the best results, the draft appliances must be so arranged as to create an equal draft at every part of the firebox. This makes it easier for the fireman to keep his fire level, and also prevents the sudden formation of holes.

No hard-and-fast rule can be given for the adjustment of the diaphragm, its position being governed by the diameter of the front end, number of flues, length of extension and distance of exhaust nozzle from flue-sheet. One of the best forms of extension fronts that has ever come to the writer's knowledge is the one shown on page 291, September, 1894, number of Locomotive Engineering, gotten up by Mr. W. H. Thomas, superintendent of motive power, Southern Railway. With this form of front end it is a comparatively easy matter to adjust the draft so as to burn an even fire all over the firebox.

The adjustment of the draft or petticoat pipe in the short front end, and in connection with a diamond stack, is an entirely different proposition, however.

In setting this pipe we must bear in mind the fact that it is the opening between the bottom of the pipe and the smoke arch that regulates the draft at the front end of the firebox, or next to the flues, while the top of the pipe regulates the fire at the back end.

To set the pipe, begin at the bottom. If your engine has a high nozzle—that is, if the top of the nozzle is 6 inches, or more, above the bottom of the smoke arch—set the bottom of the pipe about flush with

top of nozzle; if you have a low nozzle, 4 inches or less, set the pipe about an inch or more above the nozzle. If upon making a trip, you now find that your draft is too severe ahead, raise the pipe; if not strong enough, lower it, moving it a little at a time until you find the draft is right.

For the top of the pipe, it is best to have a loose sleeve that can be moved either way and fastened at any desired point.

To find the proper place to set top of pipe, cut a notch or "V" out of top of sleeve, fasten the sleeve at any point, say, 7 or 8 inches from top of arch; make a trip, then open the front end, and you will see the mark of the "V" some place on the soot in the barrel of the stack. This shows you where the exhaust as it spreads begins to fill the stack.

To obtain the best results it is desirous to have the exhaust fill the stack from a point about 2 inches from the base. In order to set the top of the pipe to do this, measure from the "V" mark inside the stack to the arch, and from the arch to the top of the pipe. Turn the sleeve over so that the straight side will be on top; set it according to your measurements, and fasten.

Example—Measuring, you find the "V" mark inside the stack within 6 inches of the base. This shows you that you must lower your sleeve 4 inches in order to bring exhaust to within 2 inches of the base of the stack. Measuring from arch to top of sleeve, you find that sleeve is 5 inches from arch, so you turn it over and lower it 4 inches, bringing it 9 inches from the arch; fasten it there, and you will find your pipe is set correctly.

I dwell on the setting of a draft pipe, because I believe eventually nearly all front ends, extension or others, will contain some form of a draft pipe, either as an extension from the bottom of the stack into smoke arch or in the form of a movable pipe over the nozzle.

The steaming of an engine often depends entirely on the proper adjustment of the draft pipe.

By the way, did you ever notice the analogy between the draft pipe and the tube in an injector? Notice the similarity in design; also that the proper working of the injector depends very much on the position of this tube, etc. Keeping the workings and form of the injector in mind, we can easily trace the analogy between it and the front end, the exhaust nozzle, the draft pipe, and the stack.

In the injector, the vacuum created by the rush of steam, the water rising to fill it, the combination of the steam and water, and the velocity imparted to it, sufficient to force it into the boiler against pressure are all duplicated in the front end.

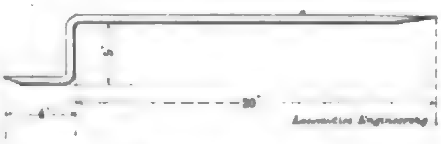
The exhaust from the nozzle, the gases from the firebox rushing to fill the created vacuum, the combination of the two, and the velocity imparted to the combination are sufficient to force it against atmospheric pressure.

Summing up, we come to the following conclusions. To obtain the best results from a given quantity of coal: First, have the greatest possible air openings in the ash-pan, but cover the openings with netting to break the violence of the air currents. Second, fashion your grates to suit the coal, and if a certain quality of coal has once been adopted, be it good, bad or indifferent, stick to it; there is nothing gained by frequent changes. Third, have the center of your nozzle in line with the center of the stack; make the nozzle as large as it will run and have action on the fire. Bore it bell-mouthed so the exhaust will spread and fill the stack at the proper point. Fourth, have your stack perfectly smooth inside and free from projections, and in diameter not more than nine-tenths the bore of the cylinders. And if using a diamond stack, don't fill the top of it with cast iron (cone) and expect the smoke to creep around the corners till it finds its way out.

F. P. Roesch.

A Useful Roundhouse Tool.

I send you herewith a sketch of a bar for putting up or taking down the side rods of a locomotive. We have been using it about four years, and from the first use we could not get along without it, especially on engines with over two wheels



ROUNDHOUSE TOOL.

coupled. The crank end will go on a spoke and hold the rod without crowding to adjust the liners and put on the strap, or it will hang over the main rod and hold the rod behind it just right. The chisel is handy to pry off straps; the sharp end for prying on straps through the bolt holes. Knowing it would be a "blank" give-away to get it patented, I will give it away without going to that expense. It is made of $\frac{7}{8}$-inch round steel.

J. F. Kingsley.

Pounding on Left Side of Engine.

It is oftener asked than properly answered, "Why does an engine pound more on the left than on the right side?" The answer from those who are supposed to know usually is, "The engineer does not give as much attention and care to the left side as he does to the right side." If the seeker for information is not satisfied with the answer, he is at least shut off from further inquiry from that source, and though he may really have no faith in the soundness of the theory advanced, he will likely appreciate its effectiveness in shutting off the inquisitor, and probably adopt it in self-defence; for it must be admitted that there are many lessons learned with that end only in view. There is nothing connected with the working of the locomotive that concerns the engineer so much, and about which he knows so little, as this very problem, "Why does she always pound most on the left side?" The wedges that have been cut, and the numberless hot pins that have been caused by efforts of the engineers to make the left side work as smoothly as the right side, a great many of which have come under the writer's observation, have told plainer than words that there is a need of information on this peculiar feature of the action of the locomotive, a knowledge of which will not only prolong the life of the parts of the machine, but that of the engineer as well; for there is nothing so conducive to premature decay as worry, and nothing so productive of worry as groping in the dark; for the only result produced in that way is increased worriment. It is a wise man who knows enough to let "well enough" alone, but he deserves most credit for knowing when things are well enough to be let alone.

The reader no doubt knows that the pound on the left side referred to takes place just after the engine has passed the forward center on that side going ahead (assuming, of course, that the right side is the leading engine); that is, that the pins on the right side are one quarter in advance of the pins on the left side.

By following the movement of the pins, and noting the action of the steam and its effect on the main driving boxes during a revolution, perhaps we can all see the result sought. Beginning with the engine at the top quarter on the right side, and going ahead, she takes steam in the back end of right cylinder. The effect on the right main driving box is, to pull it against the dead-wedge or shoe. After passing the quarter a little she is in position to exert power on the left side, has just passed the center on that side, and is taking steam in the back end of the cylinder, the effect of which is to pull the left main driving box forward against the shoe.

The next action is, the exhaust takes place on the right side, releasing the pressure from back end of that cylinder while the pressure is still retained in the back end of left cylinder, the effect of which is to cause the right main driving box to be pulled back against the wedge, the left main box serving as the fulcrum against which a forward pull on the left side causes an opposite movement on the right side. The next action is the taking of steam in forward end of cylinder on right side, and the engine leaves that center without any pound in right box, even though there be some lost motion inside or outside the box, caused by loose brass or slack wedge, because when she reaches the point where the pound takes place in the corresponding position on the left side

there is no pound produced for the reason that the box is already solidly against the wedge. We now have engine approaching lower quarter with steam in forward end of cylinder on right side, and as the exhaust has taken place on the left side, the effect of the backward pressure on the end of main axle on right side is to force end of same axle on left side forward, holding left main box against shoe on left side. Now here is a point to be noted. When engine took steam on the forward center on right side the driving box was back against the wedge, because of the effect of the forward pull of the axle on the left side. When we now take steam in the forward end of left cylinder we find the left driving box forward against the "shoe" because of the backward push against the axle on the right side, and when the engine on left side now passes the center and reaches the point where the pound takes place, the left box is forced back against the wedge with a pound in proportion to amount of lost motion in the box, which latter may be due to loose brass, slack wedge, or improperly lined shoe or wedge, which are the principal causes that contribute to the effect referred to. We find by moving the engine still further to the point from which we started (upper quarter on right side) that when the engine on right side takes steam in the back of cylinder the main box on that side is forward against the shoe, and no pound is produced after leaving the center. Also, that when the left side passes the center the left box is back against the wedge. Here the question naturally suggests itself to the reader, Why don't she pound after passing the back center as well as after passing the forward center? The reason is this: When forcing the box back against the wedge from the forward center the box is moved backward, while the engine is moving forward, consequently the left driving wheel must slide to let the box back against the wedge. When engine leaves the back center the force is exerted in the direction the engine is moving and the lost motion is taken up without the sharp familiar knock produced in the other position, because the wheel rolls instead of slides and the lost motion is taken up with comparatively little jar on account of being taken up more gradually.

If after reading the foregoing explanation the reader is still skeptical, his attention is called to the fact that an engine that pounds on the left side going ahead, and is smooth on the right side, will pound on the right side and be smooth on the left side backing up. By reversing the motion of the engine all conditions are reversed. When backing up, the left engine is the leading one, and the effect on the driving boxes is just the opposite to that in the former case, when the engine was moved ahead. A clear knowledge of the theory herein advanced is a decided benefit to the engineer, as it will enable him to make due allowance for the pound on the left side, thereby relieving him of the labor and annoyance attending the futile efforts to make the left side of the engine work as smoothly as the right side on a "right-lead engine." T. P. WHELAN.

Bellevue, O.

Notice to Correspondents.

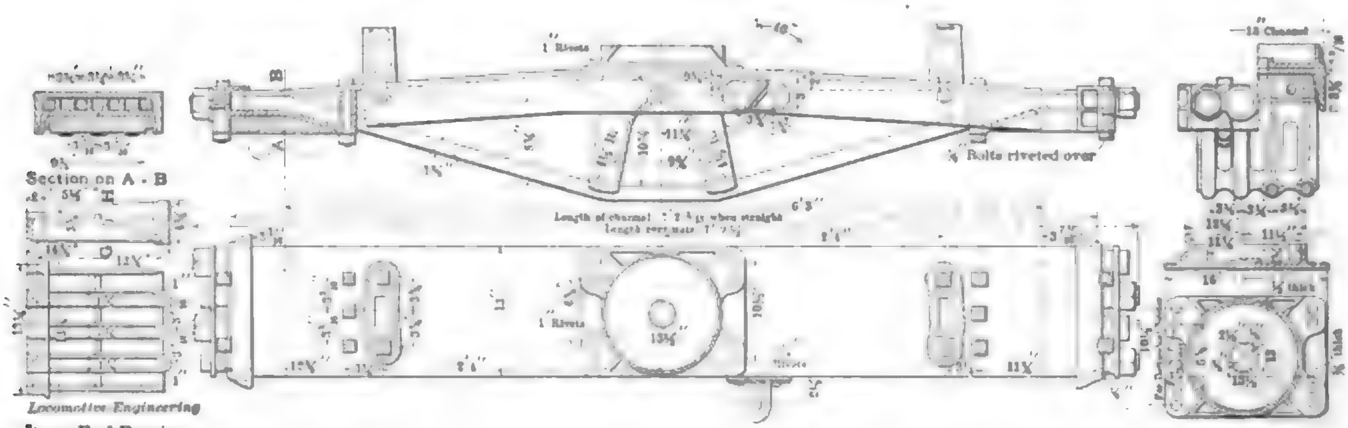
We are constantly receiving letters for this department that do not have the names or addresses of the writers. For the last four years we have strictly adhered to the rule that no letters would be published in this journal that do not give the names and addresses of the writers. We were forced to adopt this rule because certain letter-writers had used our pages to make personal attacks on others, or to use us in processes of ax-grinding wherein we and our readers were not interested. The rule works very well, and we intend to adhere to it.

Letters also come frequently to the Questions Answered department without the names or addresses of the writers being given. We do not publish these, but letters sent in without them go direct to the waste-basket.

Truck Bolster—Northern Pacific Railway.

A truck bolster in which some originality in design is apparent, is shown in our engraving of a bolster designed for cars of 60,000 to 70,000 pounds capacity on the Northern Pacific. One of the principal features—and shall we not say the most valuable to those interested in correct development of rolling stock?—is the total and absolute obliteration of the old and familiar details in wood.

The compression member is a steel channel 40 pounds per foot, and the tension members are four 1⅜-inch truss rods having 1¼-inch ends, with a distance of 10⅞ inches at the center between the two parts sustaining the load. From the arrangement of the ends it will be noted that it has the Barber roller bearings. Malleable iron is used in the end bearing castings, side bearings, truss rod center bearing and center plates—in fact, for every cast shape. The center plates have an unusually large bearing surface, 11¼ inches, which must bring the load per unit of area down below the danger point, and this is a phase of center-plate literature that will not bear investigation in all cases; but there is a strong tendency in the direction of more generous bearing surfaces, as shown here, although this is the first of the kind coming to our notice as an actual move for a better distribution of load on the center plates. We are indebted to Mechanical Engineer Thompson for the print from which the engraving is made.



Inner End Bearing

Center Plate

NORTHERN PACIFIC TRUCK BOLSTER.

The Schenectady Locomotive Works are just completing the last of a lot of thirty-five electric locomotives for the London Underground Railway. That is, they have built the trucks, cabs and all the mechanical parts, the electrical equipment being supplied by the General Electric Company at the Schenectady works. These are business-like looking affairs, having a 200 horse-power motor direct on each axle, without gearing, making an 800 horse-power motor.

Moguls for Southern Pacific Railway.

The locomotive shown in our illustration is one of a lot of twenty-six being built by the Cooke Locomotive & Machine Company for the Southern Pacific. They also have five under way, of exactly the same design, for the Mexican International Railway, being from designs furnished by the Southern Pacific Railway.

The main dimensions are given in the diagram on page 216, but in addition we note that the extended wagon-top boiler has radial stays, that the firebox is 40¼ by 108⅛ inches, and that they have steel tender frames of channel section, 10 inches deep.

They are fitted with American balance valves, with Allen ports, Westinghouse-American brakes, Sweeney brake attachment, California couplers, Leach double sanders, Dressel headlights, Nathan injectors and two 3-inch consolidated safety valves.

COOKE LOCOMOTIVE. (DIAGRAM ON PAGE 216.)

What Naval Engineers and Firemen Endure.

Those who have taken an interest in the long and stubborn fight for justice made by the engineers of the United States navy are pleased to know that the passing of the Naval Personnel bill gives the men who endure the heat and burden of stifling engine rooms and roasting stokeholds the same standing as officers of the line. Under modern conditions of naval service the safety of the ship depends more upon the skill, care and vigilance of the engineers than upon any other class. The increasing high pressures of steam, the multiplying of mechanism of all kinds and the tendency towards the highest possible speed render the life of the men who care for and operate the machinery under the decks more arduous and uncomfortable as the existing line of progress goes on. The following paragraph from a sketch by the master word-painter, Rudyard Kipling, gives a striking glimpse of the horrors of the lower regions of a modern torpedo boat:

"Descend by the slippery steel ladders into the bluish copper-smelling haze of hurrying mechanism, all crowded under the protective deck; crawl along the greasy foot-plates, and stand your back against the lengthwise bulkhead that separates the desperately whirling engines. Wait under the low-browed supporting columns till the roar and the quiver has soaked into every nerve of you; till your knees loosen and your heart begins to pump. Feel the floors lift below you to the jar and batter of the defrauded propeller as it draws out of its element. Try now to read the dizzying gage-needles or find a meaning in the rumbled signals from the bridge. Creep into the stokehold—a boiler blistering either ear as you stoop—and taste what tinned air is like for a while. Face the intolerable white glare of the opened furnace doors; get into a bunker and see how they pass coal along and up and down; stand for five minutes with slice and 'devil' to such labor as the stoker endures for four hours."

Variable Nozzles.

"Speakin' of variable nozzles," said an old-timer the other day, "we had some that would do fine if the engineers only used 'em often enough to keep them from gummin' fast."

"Was that all?" said a man who was just kickin' for more oil. "Well, by gosh! that wouldn't bother 'em any now. Don't get oil enough to grease the valve seats, let alone the nozzles."

"My idea," said a third, "is to find out how small a nozzle you need for the poorest coal they ever shove on to you. Use that for the minimum, and have your expander go as much above this as wanted. Big enough, in fact, to stop the infernal din an engine raises in a station or train shed.

"Then close her down after you get out into the open and go ahead. I don't go much on movable dinguses in the front end, but I believe this would help at times and save lots of swearing on the part of the passengers."

An Oil Finish.

Mr. Wilson Eddy had a peculiar finish on some parts of his engines. The "scape" pipes, as the boys called them, were of cast iron and turned smooth. They were not allowed to be polished, however, but were just wiped over with oily waste, and soon assumed a brown appearance from the gum baked on. They were thus smooth, rust proof and had a good appearance with a minimum of wiping and no cleaning.

The practice of passing the steam from the air pump into the tender is being adopted by many railroads with very decided benefit to the fuel record. There are still many railroads, however, which run the air-brake exhaust up the stack. Some of the companies that still follow this practice are after their enginemen all the time to interest themselves more in the practices of firing and running that will make steam with the least possible expenditure of coal. Knowing this, it is curious for an onlooker to stand at a station and listen to the air exhaust pumping the fuel gases through the smoke stack, while the safety valves are screaming "waste, waste, such senseless waste of good coal."

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To Prevent Leakage of Tubes and Firebox Sheets.

We often wonder if the time will ever come when the mechanical men of railroads will meet together in large numbers without inquiries being made of how to prevent the delay, expense and annoyance arising from leaky tubes in locomotive fireboxes. We meet with the question everywhere except in New England and a few other districts where the feed water is so soft that no incrustation is formed on the evaporating surfaces. On some roads the trouble is much greater than it is on other roads with similar conditions of feed water. The difference in favor of the less inflicted road we attribute to increased care in preventing mud and incrusting matter from doing their worst on the tubes and tube sheet. The fact that railroads using soft water have little or no grief from leaky tubes ought to convey a lesson to those wrestling with bad water as to the proper practice to adopt for reducing the evil action of impure water. That lesson is to keep the boiler as clean as circumstances will permit.

The idea has obtained some popularity of late that the best way to prevent leaky tubes is to keep the boilers at work as long as possible without washing out. That plan may succeed in some districts; but in most regions where lime and magnesia salts are present in the feed water the safest plan is to use the uttermost endeavor to force out of the boiler the mud and scale formed by these enemies of heating surfaces.

When a man responsible for the maintenance and care of locomotives asks us what is the best way to prevent leaky tubes and firebox sheets we answer, Keep the boiler as clean as possible. When the question is repeated asking for the next precaution or remedy, we are inclined to give the same answer two or three times repeated.

When the subject is pursued further we are inclined to recommend investigation into the methods of boiler feeding on the road and the practice of firing. Both these exert great influence for good or bad on the prevention of leaky tubes and fireboxes.

When a locomotive begins to be run down and gives trouble from leaky heating surfaces it soon obtains an evil reputation, and the men assigned to run it seldom try to strengthen or protect its weaknesses. Every man's hand is against what becomes known as a scrap heap, and all they care for is to get it to the terminus with as little annoyance as possible.

There are, however, some men so constituted that, when they encounter a case of this kind, they are put upon their metal and proceed to fight it. A fairly good illustration of such a case once came under the writer's notice. An engine badly run down was so notorious for leaky tubes and firebox sheets that it had been repeatedly towed in, through the leakage quenching the fire, and many of the extra men preferred to feign sickness to taking out that engine. The road was very short ot power, and the master mechanic decided to assign the engine to a man who had a regular run on a division where it was not of much importance if half or even the whole train was side-tracked when the engine happened to be misbehaving itself. This engineer, who was of observing habits, soon discovered that heavy feeding of water or heavy feeding of coal caused the tubes to leak. That gave him an inspiration, and he said to the fireman, "I want you to fire with two or three shovelfuls at a time, and keep the firebox door shut as much as possible." The engineer on his part adopted the practice of feeding the water only when the engine was working steam, shutting the injector off on descending grades and while standing at stations. This is not good practice for everyday work, but he was dealing with a special case. Under this treatment the engine improved so much that the attentions of the boiler butcher were dispensed with, and for three months it took its place in pulling full trains without a single failure.

A tender firebox, or tubes such as were the weak points of the engine referred to, naturally intensifies the care of a vigilant engineer to find out other causes that induce leakage than those common to operating in hauling trains. In the first weeks of the experiment with that engine, it was found that the engine went to the ash pit so free from leakage that the attentions of the boiler maker were not invited, and that the same engine came out in the morning leaking like a lawn sprinkler. This led the engineer to investigate the operation of dumping the fire. He found that the man charged with this duty was in the habit of opening the dump grate, starting the blower at its greatest force, and the blower was not always shut off when every cinder and clinker were deposited in the ash pit. The dampers were never closed.

The man who had made up his mind to cure this engine of leakage knew that harsh measures would do no good, so he slipped a greenback into the hands of Frank, the fire-dumper, and asked for his aid. The help asked for was to use the blower as lightly as possible while dumping the fire and to close both dampers as soon as the fire was drawn. That stopped the damage done after the engine went into the hostlers' hands.

Those interested in preventing leakage of tubes and fireboxes may find some useful hints from this true story.

Testing Steam Gages.

When a gage is suspected of registering incorrectly, it is so reported, taken off the engine to the test gage and compared with one known to be correct. If it is then found that it registers exactly with the test gage, it is replaced on that engine or used for another one.

Now, it is possible that the gage may show the pressure on the engine incorrectly and be exactly right when tested off the engine. Several things can cause this. It is possible to spring the gage when attaching it to the bracket, although all first-class modern gages are made to do away with this error. It is also possible to spring it when attaching the gage pipe, especially if substantial iron pipe is used instead of flexible copper pipe.

Heat has a very decided effect on gages if the Bourdon tube has ever been repaired by soldering the edge of the tube, for this part will not expand at the same ratio as the brass tube.

The steam pipe or siphon which connects the gage with the boiler is made like a letter "S" to keep the hot steam out and admit condensed water only. If the joint at the bottom of gage leaks so live steam comes out there, it is certain that live steam is up in the tube, expanding it with heat, so that it registers incorrectly. Look out for this defect.

On a good make of gages each dial is graduated and marked for the particular set of works it is on, and should not be exchanged to another gage. It is rarely that two dials are graduated alike. Repair men should remember this fact.

A good way to test steam gages is to have a test gage connected to the same

boiler by a piece of copper pipe long enough, so that the test gage will be in a cool place, say on the engineer's seat-box. The most convenient place to take steam for this purpose is at the joint where live steam goes to the top of the sight-feed lubricator for the cylinders, as the coupling there is a standard size on all locomotives. Uncouple this steam pipe from the lubricator and couple it to the pipe leading to the test gage, which should be filled with cold water previously. When steam is turned on the test gage you can then compare the gage belonging on the engine with it for correctness; and be sure of it, as it shows the pressure in actual service.

To test air gages, have a brass plug made, one end of which screws into the excess valve opening in a D-8 brake valve, and the other end to use with the feed valve in the F-6 or D-5 brake valve. A hole is tapped clear through this plug, so a test gage can be screwed into either end. Take out the plug in D-8 brake valve and screw this gage plug in there, with the excess valve 21 in working position. Then by placing brake valve in either full release or running position, you can test the main reservoir or train pipe pressure, as shown by the duplex gage. With the F-6 brake valve, main reservoir pressure comes against this plug in either full release or running position. So to test the black hand you will have to lap the brake valve and catch the train pipe pressure; the feed valve 63 to be taken out.

While we are talking about duplex air gages, why cannot the black hands all be painted red and the red ones black, so the black hand will come close to the dial, and we can tell nearer the exact pressure in train pipe when looking at the gage from one side? As these gages are now put up, with black hand ½ inch from the dial, the engineer sees that he has 65 pounds, while the fireman on other side thinks it shows 75. It is not so much matter what the reservoir pressure shows; and as the hands cannot be changed on account of one being outside the other, let us change the colors and the connecting air pipes to correspond, making the air gage a sure guide in reducing train pipe pressures.

Heavy or Light Driving Wheels?

In the commendable effort to lighten reciprocating parts of locomotive, most designers seem to have gone a step further and lightened the driving wheels as well, with the result of producing a beautiful wheel, from an artistic point of view, but there seems to be another side to the question.

No one claims it to be a reciprocating part, so that weight here, if in perfect balance, will not affect the riding of the engine or disturb the track with the awe-inspiring hammer-blow. Why, then, lighten the driving wheels at all, and what is gained by so doing?

Where, as is occasionally the case, a builder is limited to very close margins of weight on track, it is, of course, necessary to do this, but in ordinary cases we fail to see the advantage.

Weight in a driving wheel adds to the adhesion of the locomotive without increasing the weight on the journals, and puts the weight where it is most effective. It also lessens the effect of the counterweight on the track, as it increases the ratio between the weight of wheel and weight of counterbalance. This can be easily tested by taking a light rim pulley and adding a given weight at any point on the rim. Then take a very heavy rim pulley of the same diameter and put the same weight on the rim. The difference in the effect as producing a hammer-blow is apparent.

Resenting Our Articles on Firing.

There is good reason to believe that our advocacy of the method of firing locomotives which will prevent volumes of black smoke from being poured out of the smokestack, to the discomfort of everybody who rides behind the locomotive, has not been accepted by all concerned in the friendly spirit in which it was given. Our subscription agents, and others in a position to judge, say that the articles about good firing have cost us thousands of subscribers. They tell us that certain classes of enginemen are so incensed at our articles telling how locomotives can be fired with bituminous coal without smoke, that their only sense of dealing with the case is to stop the paper or refuse to renew their subscription.

From a business standpoint we are very sorry that enginemen who had ever been intelligent enough to think that reading and studying Locomotive Engineering was likely to aid them in learning their business, should come to distrust the educational work the paper is doing. Before all things, Locomotive Engineering is an educational paper. When the editors find out that certain methods in handling the air brake will likely bring an engineer into trouble at some remote time, they proceed to instruct that engineer on the sound principles of his business. In all the range of responsibilities that come to the engineer and fireman, Locomotive Engineering discusses the particulars in the most intelligent manner within its lights, and advises all concerned to make sure that they are right, and then go ahead. But we have always advocated the principle that every man, whatever might be his sphere of life, senator or wiper, ought to do his best in the vocation in which circumstances have placed him. Regarded from the highest human standpoint, the wiper may be a man much superior to the senator.

While we are convinced that there is a temporary prejudice in some quarters against Locomotive Engineering on account of the stand it has taken in favor of the best methods of firing locomotives, we do not think but what there will soon be a decided reaction in favor of men doing their best. We have had a great deal of experience among mechanics, and we never yet found what may be called a slouch or an inferior hand who had the respect of his fellow workmen. The man who is the master workman is the individual who is a natural leader of the others.

A fireman of the ten-shovel practice may have his way of keeping a boiler hot under favorable circumstances. In the old times it was no more against him that he used two more tons of coal in a run of one hundred miles than another fireman did who had become skillful in his business. Both these fellows were in the same boat with two machinists who worked under different lights. One believed that the trade was benefited if he took ten hours to finish a job which a fellow workman could finish in seven hours. But the advanced knowledge of what a man can do either in firing coal or in finishing a set of links is not favorable to the inferior mechanic. Those who blame us for urging the man who converts coal into heat to make the greatest volume of heat out of the coal thrown into a firebox are not standing on a pedestal likely to bring them any admiration. A man who blames a paper like this for advising him to do his work in the best possible manner is a slouch unworthy of employment by anybody, be it railway company or street sweeping bureau.

Weight of Steam and Water.

Everyone who is accustomed to reading engineering papers or books is constantly meeting the expression "weight of steam," and many of them are puzzled to understand how the gas steam can have weight that would be felt on weighing scales just the same as a gallon of water. Yet there is nothing more certain than the fact that a gallon of water converted into steam will weigh the same as it did before heat was applied to do the evaporating. If you put a gallon of water into a closed vessel and put a spirit lamp or other source of heat under it, and transmit sufficient heat to convert all the water into steam, it will weigh the same as the water did. But if the steam was permitted to expand to the pressure of the atmosphere, it would occupy 1,644 times the space it occupied as water. The fact that it now fills much greater space does not in the least change its weight.

In the process of converting water into steam, the heat applied has no influence on the weight of water or steam. The mass remains the same weight that it had in the beginning. This proves the fallacy of an ancient belief that heat was a material substance that passed from a cold to a warm body and added its own weight to the latter. Heat is now believed to be a condition of matter in which the molecules enter into active motion, rubbing and clashing against each other with amazing

rapidity. In solid bodies this action is comparatively slow; when sufficient heat is added to produce liquifaction the action is greatly increased, and when the temperature of vaporization is reached a very great activity is produced that is only surpassed by the temperature that separates any compound into its elementary gases.

Labor Injured by Laws in Its Favor.

In securing laws for the protection of workmen, the friends of labor sometimes do their constituents more harm than good. This has been conspicuously the case in foreign countries. Nearly a year ago the British Parliament passed a measure called the Workmen's Compensation Act, which has led to at least one deplorable consequence to the class it was meant to benefit. Notices have been posted wholesale among the great industrial concerns of England discharging men who are over fifty years old. Their continued employment would have involved higher premiums to the insurance companies which the employers have called in to cover the liability that the act puts upon them. Thousands of old miners, dock laborers and shoemakers are thrown out in the northern districts and their cases occupy every meeting of the local Poor Law Guardians. The following notice has been issued by the Barrow (England) Hematito Steel Company:

"From this date forward please note that no men are to be engaged who are known to have any defects, such as the loss of a limb, defective sight or hearing. Further, no men are to be engaged in any department who are older than fifty years of age. Any man already in the employ of the company in excess of this age may be retained, but in case of their leaving they are not to be re-engaged."

The same process goes on at the Welsh quarries, the Northumberland coal mines and the Liverpool docks. In many employments the discharged men have been replaced by lads. The difference is that old men have dependents upon them for a certainty. That is not likely with lads, who consequently are cheaper on the scale of legal compensation.

Another objection taken to the act is that universal compensation leads to carelessness, and thereby tends to increase accidents. The official figures for the last six months of last year show an ominous increase of accidents. The fatal cases have risen by 12½ per cent., and the non-fatal by 43 per cent. In the latter class the increase is doubtless due to some extent to improved notification under the new act. Moreover, it is evident that some people would almost court slight accidents for the sake of the compensation. But the list of deaths is not to be explained away. All deaths from accident have for very many years been reported to the police and the Coroners for the purposes of inquest. Yet these have increased somewhat in the staple employments in Great Britain since the act came into operation. The additional killed (compared with the corresponding period last year) are: On railways, 3; mines, 36; quarries, 21; factories, 71; and miscellaneous, 7. Of course this does not mean that employers would destroy workmen in order to pay compensation, or that workmen would make an end of themselves so as to leave their families provided for without further trouble. But there is no doubt that with the universal habit of reinsuring against the Compensation Act, there is not now the same constant care to avoid accidents that the combined knowledge of individual liability on the part of the employer and uncertainty of compensation on the part of the employed formerly impressed upon all classes engaged in British industry.

Operating Injectors.

The question is very frequently asked, why injectors in actual service on the engines do not give the results attained in factory tests, either as to the quantity of water handled per hour or in the case of hot feed water; why so many injectors break and refuse to handle water of a lower temperature than the factory tests show they will do. There is no doubt that the conditions under which injectors operate in service on a locomotive are much more trying than on a testing plant. The constant swaying of the hose when the engine is running has a tendency to disturb the flow and volume of the water supply passing through it. When the water gets low in the tank there is of course less head to force it to the injector, and when it has only a few inches left and is surging back and forth in the tank at times, the injector gets a limited supply of water, as well as the chance for air to work down. Even if it does not get around to the injector, it breaks the flow of water down through the hose.

But the greatest difference with injectors on testing plants and on engines is from the effect of hard water. A scale forms in the tubes and changes their form and diameter. The exact shape of both combining and delivery tubes is a matter of such delicate adjustment to produce the highest efficiency, that when they scale up in service on a locomotive, it is no wonder that there is complaint, that restarting injectors do not restart; that hot-water injectors refuse to handle hot water at all times, and that none of them will handle the amount guaranteed. In the last instance, it is very often due to the restricted openings which the water has to pass through on its way from the tender to the injector. On many roads the same size opening in the nipples to which the hose is connected is used for a No. 10 injector, that has been used for a No. 6. Unless there is a wire coil in it to keep it distended and in an easy curve, as soon as it gets old the hose kinks and stops the flow of water.

The men in charge of the designing and maintenance of the supply pipes to the injector, and delivery pipe to the boiler, do not all recognize the importance of the proper dimensions and arrangements of these adjuncts to an injector. Too large a supply pipe is a detriment, especially if the injector is set very high above the level of the water in the tank; for when this supply pipe gets full of hot water, it takes longer to get the injector to prime. Hot supply pipes from steam or hot water leaking back through the injector are the rule, not the exception, in service on locomotives.

Too small a supply pipe is more often found on the tender than on the engine, as they are liable to be of cast iron, in which the outside size to fit the inside of hose is made the only important dimension, leaving the inside to the ideas of the core-box maker. Hose should be long enough so that they will not kink, and the pipes which they connect should be pointed or bent, so the hose would take an easy curve.

If conditions of service are taken into consideration, injectors will make a better showing.

BOOK NOTICES.

"Small Accumulators," by Percival Marshall. Published by Spon & Chamberlain, 12 Cortlandt street, New York. 50 cents.

This is a small elementary handbook which should do much to dispel the mystery that is usually attached to "storage" or "secondary" batteries by showing how they are made and why they work. Directions are given for making small accumulators, for charging them after they are made, and using them when charged. There are also many suggestions which will be of assistance to any of our readers who dabble in electricity as a pastime or otherwise.

"Machine Design," by Forrest R. Jones. Published by John Wiley & Son, New York. Part 1, $1.50; Part 2, $3.

The first volume deals with the kinematics of machinery, giving the principles of mechanical motion in a clear and concise manner. This is done in such a way as to show their application to practical cases and shows the designer how to attack his everyday problems. The author quotes freely from good authorities and tells the reader where full discussion of the subjects can be found. This volume deals with gearing, couplings, belts, cams and parallel motions, the construction of indicators being used to illustrate the latter. Part 2 is a book of 353 pages and is a valuable addition to the first volume. Among the subjects treated are: Bearing and lubrication, spur and friction gears, screws and screw gearing, keys, pins and forced fits, shafting, friction coupling, flywheels and pulleys, cylinders, riveted joints; frames of punching, shearing and riveting machines, as well as a chapter on

the selection of materials. This differs from many works on machine designing, in that the author has been in direct communication with the manufacture of modern machinery, and has embodied approved methods in this book instead of giving obsolete examples. There is little that can be said in a brief review which conveys an adequate idea of a really good book, but we feel sure that anyone interested in this subject will consider it a valuable addition to their library.

"The Evolution of the Steam Locomotive." By G. A. Sekon. London. The Railway Publishing Company, Limited. Price five shillings.

This is a highly interesting story in many respects, and corrects a great many fallacies concerning the men who deserve credit for original work on the development of the locomotive engine. Thousands of intelligent people believe that the locomotive was invented and developed by George Stephenson, but the author proves that Stephenson was an utter charlatan as an inventor and that the principal work he did on the locomotive was by pirating the inventions of other men. This has been well known to well-informed people for a long time; but the evidence that Stephenson was the worst kind of a humbug was never before collected in convincing form, and the author of this book deserves credit for adducing unquestionable testimony to show where credit was due and where pretense was false. Let it be known to all railroad men that the man who pretended to be the inventor of the locomotive never invented anything, and only built engines that were inferior imitations of machines built by abler men, whose only weakness, compared to Stephenson, was that they did not claim everything in sight. The author of this book seems to have enjoyed exceptional opportunities for obtaining information about the history of British locomotives, and he traces the gradual evolution of that form of engine with convincing proof of the accuracy of the many facts stated. He follows step by step the advances from the crudest kind of experimental locomotive to the modern locomotive of the British Isles, and identifies with fairness the inventors and engineers who have left their mark during the process of evolution. The book, however, is not correctly named. Instead of "The Evolution of the Steam Locomotive" it ought to be called "The Evolution of the British Locomotive," for the author writes as if he had never learned that there were locomotives in other countries that do not conform exactly to British models.

"Verbund-Locomotiven" is the title of an illustrated catalogue showing locomotives of the Golsdorf system used in different parts of the world. The catalogue says that in the year 1893 the first compound locomotive with the Golsdorf system was put upon an Austrian railroad, and in the middle of 1898 more than 900 locomotives of this system were in use. The illustrations show that this kind of compound locomotive has been adopted for nearly all kinds of railroad service, for all kinds of gages, for roads with heavy grades and for roads practically level. We notice that the engine built for the Pennsylvania Company, after the Golsdorf system, is illustrated in the catalogue. The catalogue makes an interesting study owing to the great variety of shapes the locomotives are seen in different countries and on different railroads. Some of them are shown with wonderfully complex mechanism, the Pennsylvania engine being noted for its severe simplicity compared with the others. Alex Friedman, Vienna, Austria, is the editor of the catalogue, and we received it from him. It is written in German.

Losing a Car Out of a Train.

The losing of a car out of a train without the trainmen knowing of it, as mentioned in our April number, was by no means an unprecedented event. In the last two weeks we have received several letters giving particulars of similar accidents. Among these is a long letter from Mr. C. J. McMartee, Rutland, Vt., in which he gives particulars of a car getting lost out of a train as long ago as 1858, and its loss was not discovered until the conductor's bills were checked at the end of the run.

Another letter mentions an accident of the kind that happened in Colorado in winter. In this case the car was buried in the snow and was not found until the snow melted in the spring.

The One Rail Railroad Humbug.

The one-rail locomotive which was industriously advertised a few years ago in this country has landed in England—at least the gas bags that do the shouting about that motive-power freak have crossed the Atlantic. For months reports were circulated that the owners of patents covering a single-rail locomotive and railroad were going to build a line between New York and Philadelphia, and that the run of ninety miles would be made in one hour. One locomotive was built and was exhibited as a show on a short road near Coney Island.

Now an English paper announces that "within a short time a lightning express railway will be constructed between Liverpool and Manchester, on which trains will be run at the rate of 100 miles per hour. The new line will differ from the ordinary track in that it will consist of a single rail, elevated 4 feet from the ground and supported on A-shaped steel trestles. The coaches intended for the line will be fitted with wheels in the center, and these will be run on the rail. They will be like the position of the saddle pack which hangs on each side of the camel's back."

The whole thing is a humbug, and we advise our English friends to have no financial dealings with the scheme.

A fake sensation went through the newspapers a few weeks ago, for which a reporter of the Associated Press was responsible. A discovery was made that feed for sea water connection was leaking badly on the monitor Amphitrite while the vessel was lying off Sandy Hook. The necessary repairs were made and the vessel proceeded to Norfolk. A reporter of the Associated Press heard about the trifling accident, and spread over the land the story of the narrow escape the monitor had from destruction from a boiler explosion. The belief was expressed that if the leakage had not been discovered in time a disastrous boiler explosion would have happened, sinking the vessel. It never struck the sensation monger that men in the stoke hold were constantly watching to see that the water in the boilers was kept at the right height. It was the same as saying that a locomotive explosion was narrowly averted because a feed pipe broke.

Those who are inclined to be nervous about the permanent value of the Master Car Builders' vertical plane coupler as a means of holding cars together should send to Mr. J. W. Thomas, of the Nashville, Chattanooga & St. Louis, for copies of his monthly reports on the cause of trains parting. Full particulars concerning every break-in-two of trains have to be reported by the trainmen, and the data are tabulated every month. In the month of December we find that sixty-two partings of trains occurred, forty-two of them resulting from defects in link and pin couplers, and twenty from defects in vertical plane couplers. Most of the latter partings were due to the knuckle opening due to worn knuckle or worn pin.

Reading Mechanics.

In a recent conversation with an engine builder who makes yacht engines, and who has recently built some for England, he said: "The reason I can build engines for England or anywhere else is because my men read more than English workmen do. I haven't got a man who don't read at least one daily, and most of them read mechanical papers as well. As long as my men read, I'm all right; if they stop, other countries may get ahead of me."

This same thing applies in all branches of business, railroads more than many others. Progress in the development of mechanism is so rapid in railroads, and improved methods of producing, repairing and handling machinery go on so steadily, that the man who does not read technical papers soon becomes a back number.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(48) Student, Montreal, Que., writes:

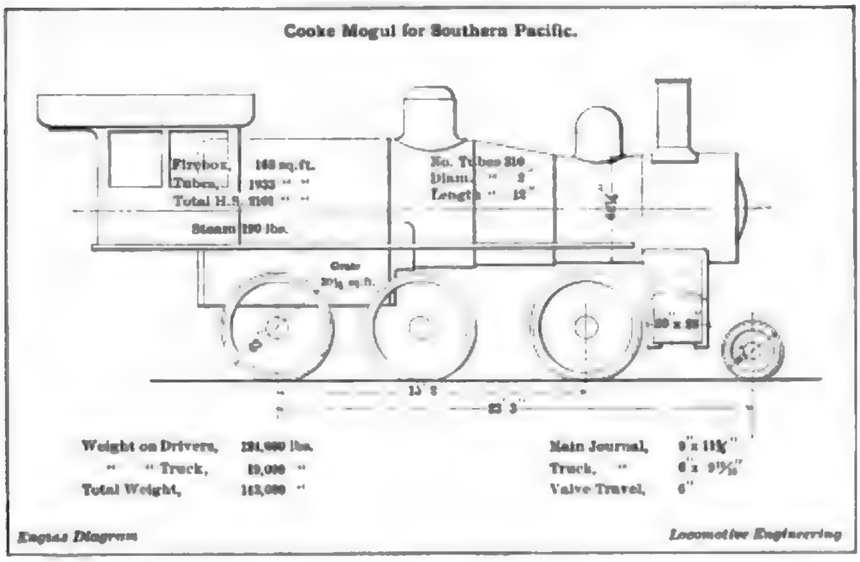
Please tell an interested reader of LOCOMOTIVE ENGINEERING about what is the temperature of the firebox when an engine is pulling hard and the fire looks white? A.—About 2,500 Fahr.

(49) D. B. L., Scranton, Pa., writes:

Do you know of any locomotive still in use that has the V-hook style of valve gear? A.—On page 414 of last year's volume you will find the description of a locomotive still in service which has V-hook valve motion. If any of our readers know of others we would gladly hear from them.

(50) J. A. N., Northampton, Mass., writes:

I would like to ask your readers if while running locomotives they ever had the water get on top of the steam so that it would show steam in bottom gage and water in top. A.—We have known cases of this kind happen for a brief period when the engine was foaming badly or was using bad feed water.



Cooke Mogul for Southern Pacific.

(51) G. M. D. R., Savannah, Ga., asks:

What is the difference between a jet condenser and a surface condenser? A.—With a jet condenser the water used to condense the steam is injected inside the condenser; with a surface condenser the water is passed through small tubes. The principal advantage of using a surface condenser is that the soft water of the condensed steam can be returned to the boiler.

(52) S. C. C., Hartford, Conn., writes:

I have heard that among engines built from the same drawings, exactly alike in every detail and run under the same conditions, no two will act alike. One will steam more freely than another, etc. Can you give any reasons for this difference in behavior? A.—The difference is largely imaginary. It may be that one engine will have certain hidden defects which make it act differently from the others; but if the defects are remedied, it will act in the same way as the others.

(53) C. W., Durango, Colo., writes:

Do you know of any tests being made to show, when a train consists of loaded and empty cars, if it pulls harder when the empties are ahead and the loads behind than it would if the loads were ahead and the empties behind? A.—We know there is a general impression among railroad men that when loads are put behind empties a train will pull harder than it does when the loads are in front. The Chicago, Burlington & Quincy Railroad Company made dynamometer tests to ascertain if the popular theory in this respect was correct, and they could not find that there was any difference.

(54) R. J. B., Savanna, Ill., writes:

With an engine of given dimensions, if I add one inch to diameter of cylinder, do I increase the power of engine the same as I would to add two inches to length of crank? What is the relative proportion between increase of crank and increase of cylinder diameter? A.—That is a question which any man can solve for himself by working up the figures according to the formula on tractive power of locomotives, to be found in almost any engineering book. It is very simple figuring and requires only a knowledge of the first four rules of arithmetic. Increasing the diameter of a cylinder one inch or increasing the stroke two inches gives about equal increase of power.

(55) M. L. H., Galesburg, Ill., writes:

1. It will be noticed that in reducing speed of trains the water in back water glass will go out of sight, presumably rushing ahead. Is there any danger of scorching crown sheets? A.—Very little. 2. Do you think an engine can be fired as economically with two or three small shovelfuls of coal as with one large one? A.—Yes. 3. Can an engine pull as much tonnage backing up as she can going ahead. A.—Not as a rule. Many engines have the valves in forward motion adjusted at the expense of the back motion, which slightly decreases the tractive power. Then in backing up there is always more or less wetting of the rails from drippings from tender and feed pipes which causes slipping.

(56) Scientific Researcher asks:

1. Will a hollow ball, say 10 inches in diameter, containing an air pressure of 100 pounds per square inch, when submerged in water, rise quicker than similar ball containing only atmospheric pressure? A.—1. If you stop to consider that air has weight as well as other substances, you will see that the greater the pressure the less buoyant it will be, because it will be heavier. At a temperature of 60 degrees, 1 cubic foot of air at atmospheric pressure weighs .0765 pounds, at 100 pounds pressure it weighs .5926 pounds. 2. Are air chambers of ships filled with compressed air or air at atmospheric pressure? A.—2. Water-tight compartments, which are the only air chambers most vessels have, are filled with air at atmospheric pressure.

(57) S. H. D., Missoula, Mont., writes:

McShane's work, "Locomotive Up to Date," also a number of writers in LOCOMOTIVE ENGINEERING, instruct as follows: In disconnecting a two-cylinder Schenectady compound low-pressure side, remove broken rod, block cross-head at back end of guide, clamp valve back far enough to clear exhaust port. Exhaust steam from high-pressure side will then pass through low-pressure cylinder to atmosphere. Under this method there would be nothing but exhaust pressure in receiver, and this would not hold intercepting valve back, but allow it to move forward far enough to admit live steam into low-pressure steam chest, and through open exhaust port to atmosphere. I contend in disconnecting in the above manner it would be necessary to fasten intercepting valve back in compound position. Please say if I am right. If not, explain. A.—Mr. McShane's directions regarding disconnecting this type of compound are incorrect. The engine should be disconnected in the same way as a simple engine, the separate exhaust valve being opened in the usual way, in order that the engine may run simple. A free exhaust for the high-pressure cylinder is thus provided through the separate exhaust valve, and the low-pressure cylinder will be fed by steam through the intercepting valve, in the same way as if the locomotive were being operated simple in climbing a heavy grade or starting a long train. This answer was written by the Schenectady people.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Sixth Annual Convention of the Air Brake Association.

The convention was called to order in the Cadillac Hotel, at 9 A. M., on Tuesday, April 11th, by Second Vice-President Blackall. Mayor Maybury was introduced, and welcomed the members and their guests to the city of Detroit.

THE MAYOR'S ADDRESS.

"The water stations in Detroit are far apart," said the Mayor. "Don't slow down or set brakes. Should that blue-coated inquisitive individual with a silver star on his breast, standing on the corners of our Detroit streets, attempt to slow you down, pay no more attention to him than to merely salute him. He has been instructed to permit fast running in city limits during the next three days, while you are in convention, and will permit entire disregard of city slow orders."

The Mayor then contrasted the old stage coach traveling with the fast railway train of to-day, and paid a pretty tribute to George Westinghouse, whose ingenuity had made high speed of railway trains possible.

Chairman Blackall, in a neat little speech, explained that Mr. C. P. Cass had entered the employ of the Westinghouse Air-Brake Company since his election last year, and had thereby become disqualified to hold office. But as Mr. Cass had conducted the association's affairs during the past year, Chairman Blackall requested Mr. Cass to address the convention. He did so, and some valuable recommendations were given.

On motion by Mr. Nellis a special vote of thanks was voted to Mr. Cass for his painstaking and efficient service while he was an active member of the association. Chairman Hutchins then read the paper on "Air Gages for Air Signal and Driver Brakes."

Mr. Andrews said that all engines on the New Haven road have gages on the driver brakes and excellent results were being had.

Mr. Hall said his driver brakes were tested by air gage and required to lose no more than 10 pounds in five minutes.

Mr. Desoe cited a case on his road where a hose-burst occurred in the signal line on an express train. One blast resulted, but was disregarded, as per rule. The conductor attempted to use the signal, and was unable to get a blast. This brought out the use of the air gage on the signal line, and which later on was extended to the driver-brake cylinder. Mr. Desoe said his officials considered the extra expense a paying investment.

Mr. Kidder thought the expense of an extra gage might be avoided by using a three-way cock in the pipe leading to the air gage, and make one gage do for all.

Mr. Best thought the practice of applying a gage to the signal line and brake cylinder was a good one, providing it was not too expensive.

Mr. Hedendahl deemed the use of gages on driver brakes especially good on mountain roads.

Mr. Nellis criticised the briefness of the report, and called attention to the fact that better committee work was necessary. In the absence of Chairman McKenna, Mr. Nellis read the paper on

THE HIGH-SPEED BRAKE.

The report was written in a historic and descriptive manner, bringing the high-speed brake from its inception up to the present time.

Mr. Auger gave some interesting figures of experiments made by him with the high-speed brake.

Mr. Roney, of the Lehigh Valley, said that the high-speed brake on the Black Diamond Express is giving perfect satisfaction.

Mr. Durant had ridden on the engine pulling the Empire State Express, and had there observed the splendid work of the high-speed brake.

Mr. Close stated that the high-speed brake with which he equipped the Congressional Limited, Erie Flyer and other fast trains were all doing perfect work.

Mr. Farmer explained the two-pressure system used on the ore trains of the Northwest, where highest braking force and freedom from slid-flat wheels were had by using low pressure for empty trains and high pressure for loaded trains.

On motion, the discussion was closed, and the report accepted.

TOPICAL DISCUSSION.

As it was now 12 o'clock, the reading and discussing of regular committee reports were suspended, and topical discussions begun. The first was

DISPOSITION OF THE AIR PUMP EXHAUST.

Mr. Goodman gave a favorable account of the system of heating feed water used on his road.

Mr. Ettinger said one of the systems had been used on the Wabash for a year past with good results; but occasionally a careless engineer would allow the water to become too hot.

Mr. Goodman said in reply to Mr. Kidder that the system used on the Northern Pacific was so arranged that, as the water in the tank fell, less area of pipe was exposed, and overheating of the water was thereby prevented.

Mr. Kidder believed that the feed-water system was the better one, as additional service was had from the exhaust steam.

In reply to Mr. Kolseth, Mr. Ettinger said that the feed-water system somewhat reduced the speed of the pump.

Mr. ——— said that on the Northwestern road, where the feed-water system had been used, the water would syphon from the tank through the pump when pipe connection was under the tank, but was overcome by putting the exhaust pipe over top of cab.

In reply to Mr. Hall, Mr. Lane said that the saving in fuel was 1 per cent. in every 11 degrees heated.

Mr. Desoe said that in the system on his road where the exhaust steam of the pump was condensed through 105 feet of 1½-inch pipe lying in the bottom of the tank, the back pressure on the pump was 20 pounds at the beginning of exhaust for an instant and then dropped to zero.

Mr. Hedendahl told how exhaust steam from the air pump was used to heat passenger cars on the Union Pacific.

Discussion closed. The next topical discussion was

SHOULD THE WATER BRAKE BE USED WHEN THE AIR BRAKES ARE SUFFICIENT ON MOUNTAIN GRADES?

Mr. Hedendahl was in favor of liberal use of water brake on mountain declines, as it keeps the valves and cylinders in good condition. He advocated a continuous use of the water brake during descent of grade.

Mr. Goodman was said to have made some extensive tests with the water brake on the Northern Pacific, and being called upon gave some very interesting information.

Mr. Cass had no experience with the water brake, but said that many engineers with whom he had talked were greatly in favor of it.

Discussion closed.

After a logical speech by Superintendent M. P. Miller, of the Michigan Central road, the convention adjourned to meet at 9 o'clock next day.

In the afternoon the ladies of the convention were given an excursion to Mt. Clements. In the evening 175 members and ladies attended the Lyceum Theatre, where "The Charlatan" was given by the De Wolf Hopper Comic Opera Company. In a speech before the curtain, Mr. Hopper said among other witticisms, "I am particularly pleased to see so many of the Air-Brake Men's convention present. I wish they would break in two that air 'On the Banks of the Wabash.'"

WEDNESDAY'S SESSION.

The convention opened with Second

Vice-President Blackall in the chair. Chairman Pratt read the paper on

CAUSES OF TRAINS PARTING.

The report was full and instructive, dwelling at length on freight train operation, independent driver brakes, hand brakes, etc.

Mr. Hedendahl praised the report, and

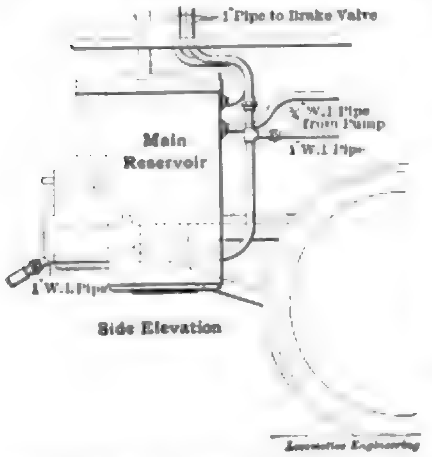


FIG. 1. SHOWING PIPING OF MAIN RESERVOIR ON A FREIGHT LOCOMOTIVE.

said that the treatment of hand brakes and independent driver brakes by the committee was timely and proper. He believed the use of an air gage in the caboose would largely reduce break-in-twos, and thought a 10-pound reduction on a freight train too heavy.

Mr. Frazer endorsed Mr. Hedendahl's remarks.

Mr. Hedendahl said that the Union Pacific road had made tests with two methods of independent driving brakes for controlling slack. The retaining valve proved satisfactory for a shorter train. A cock in branch pipe had given better results for longer trains.

Mr. Farmer and Mr. Hedendahl believed trainmen should not be burdened with blank reports to fill out.

Mr. Farmer's experience with long, heavy trains led him to believe that a little shock is preferable to losing a brake,

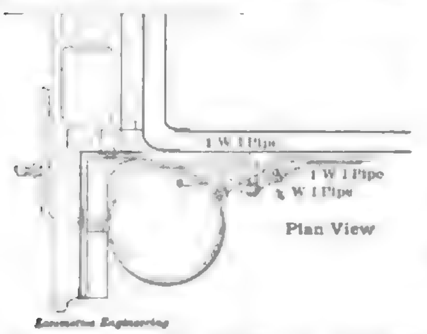


FIG. 3. SHOWING PIPING TO RESERVOIR PLACED UNDER CAB AND AHEAD OF CAB BRACKET.

and that therefore a 10-pound reduction on such trains would not produce detrimental results.

Mr. Best explained the well-known system employed by his road in locating cause of break-in-twos, and said that since the system was introduced the break-in-twos have been greatly reduced.

Mr. Durant believed that the report of the committee and the discussion of the members showed that break-in-twos attributed to the air brake were in many cases really due to defective car couplers.

Mr. Smith believed that many break-in-twos were induced by rough handling and rough switching of trains in the yards.

Mr. Hutchins believed many break-in-twos were due to placing the brake valve in full release position, after a light application, before the discharge at train pipe exhaust had finished.

Mr. Synnestvedt endorsed Mr. Hutchins' views, and noted that break-in-twos due to air brakes were almost wholly confined to time of release rather than time of application.

Mr. Johnson said that break-in-twos attributed to air brakes were sometimes wrongly placed on the engineer by the conductor alone making out the report.

Mr. Gill said break-in-twos on the Grand Trunk road had been reduced by having the second engine of a double-head train do the starting, and the second engine assisting gradually.

Discussion closed, and upon motion the topical discussion was abandoned and committee reports continued.

Ex-Governor Rich, upon invitation, responded with a speech in which he expressed sympathy with objects of the Air-Brake Association, and gave a short history of the equipment of cars with air brakes in the State of Michigan. Mr. Rich has also served his State as legislator and railway commissioner.

Chairman Parker then read the report of the committee on

AIR-BRAKE RECORDING GAGE.

The report was carefully prepared, and contained illustrations of charts taken from trains in service.

The discussion of the report was deferred until to-morrow's session.

A special vote of thanks was given to General Superintendent Dunham, of the Plant System, for his interest shown in the Air-Brake Association by sending sixteen representatives in a private car to the Detroit convention.

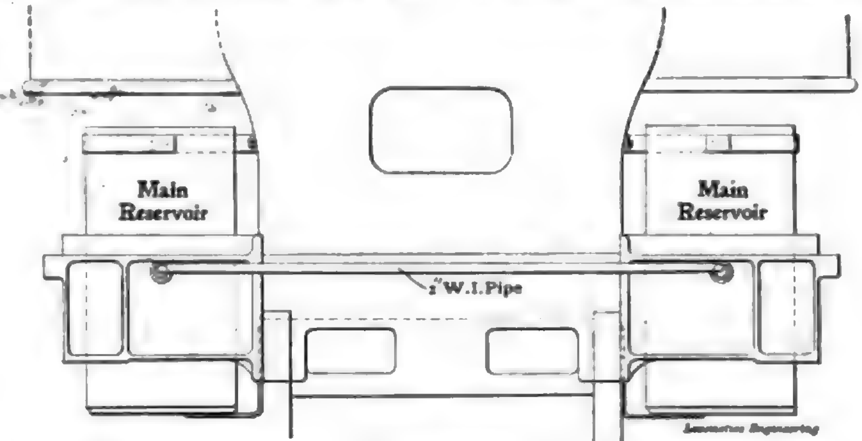
The convention adjourned until 9 A. M. Thursday.

In the afternoon the ladies of the convention took a tally-ho ride. One of the local papers said:

"The ladies are a feature of this convention. In their spring gowns and hats they are the center of attraction. The attendance at the convention sessions suffers somewhat in consequence. Yesterday afternoon they mounted two brilliant tally-hos, with long-horned attendants, and rode around the city as though they owned it. They were mightily pleased with the excursion."

Meanwhile, several special street cars were provided the members for visits to the Detroit & Michigan Lubricator Works. About forty made the trip. The Magann Air-Brake Company's works were also visited.

In the evening an impromptu hop was given the members and their ladies by the hotel management in the banquet room. The hotel orchestra was in attendance, and an enjoyable time was had.



End Elevation

FIG. 2. ONE METHOD OF SECURING LARGE MAIN RESERVOIR CAPACITY ON A FREIGHT LOCOMOTIVE.

THURSDAY'S SESSION.

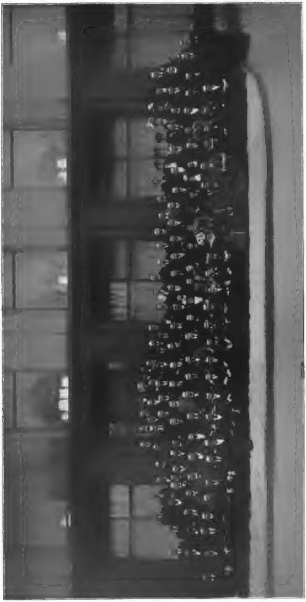
Convention opened at 9 A. M., Second Vice-President Blackall in the chair. Chairman Parker opened the discussion.

Mr. Frazer said the horizontal type of recorder had given good service on the Southern Pacific. The speed of the chart was three feet per hour, and gave detailed results.

Mr. McKee said he had had several years' experience with the revolving disk type, but was waiting to see the development of the horizontal type, as that gave promise of superiority over the revolving disk.

Mr. Farmer believed from experience that the circular type was amply sufficient.

Mr. Wahlert's experience with the de-



AIR-BRAKE MEN'S CONVENTION AT DETROIT, MICH.

velopment of a recording gage taught him that the horizontal type was superior to revolving disk, as more accurate and refined detail was obtained.

Mr. Nellis said detail should not be sacrificed in order to economize on recording paper. Discussion closed. Chairman Farmer then read the report of the committee on

ORGANIZING AND CONDUCTING THE AIR-BRAKE DEPARTMENT OF A RAILWAY.

The report contained many valuable and

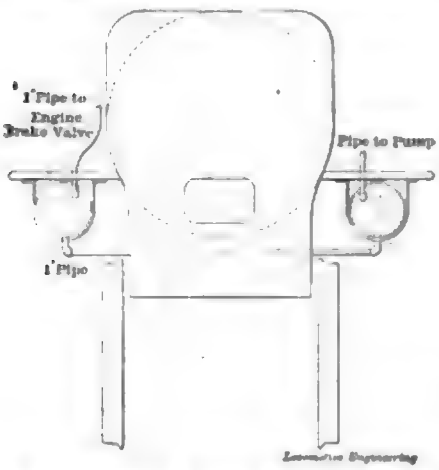


FIG. 4. ANOTHER METHOD OF PLACING TWO LARGE STORAGE MAIN RESERVOIRS ON A FREIGHT LOCOMOTIVE. OBSERVE THAT AIR IS PUMPED INTO ONE RESERVOIR AND USED OUT OF THE OTHER.

sensible recommendations; was quite lengthy and showed careful preparation.

Mr. Desoe, when asked to speak on the paper, complimented the report. He had nothing to add or criticise.

Mr. Conger, Mr. Farmer and others of the committee, solicited criticism on the report, as it was not believed perfect.

Mr. Johnson, speaking as an engineer, praised the report as good for enginemen.

In line with the recommendations of the committee, Mr. Cass cited the process of testing brakes in plants on the Santa Fé.

Mr. Pratt gave some valuable information drawn from his experience.

Mr. Hutchins thought cautious consideration should be given the cost and maintenance of the air-brake department. Discussion closed. Chairman Hedendahl read the report of the committee on

STEAM HEATING OF PASSENGER EQUIPMENT.

The report was full and complete, treating all systems of steam heating employed, and gave intelligent directions for care and maintenance.

Mr. Desoe explained method he employed in thawing out frozen steam-heat hose.

Mr. Hall used a different method. Mr. Gill favored Mr. Hall's plan.

Mr. Hedendahl said that it had been found desirable to carry a higher pressure on the indirect or jacket system than on the direct system of steam heating.

Mr. Sinclair was invited to address the convention, and responded in a happy vein of humor. He expressed himself as being in sympathy with the association's affairs and work, and complimented them on the success of their undertaking. Convention adjourned to meet again at 1.30 P. M.

Afternoon Session.

Convention opened at 1.30. Chairman Alex. Brown read the report of the committee on

HOW THE EFFICIENCY OF AIR PUMPS MAY BE BEST INCREASED AND MAINTAINED.

The report was based on indicator-card tests, and many valuable points were brought out. Mr. Brown urged the reboring of air cylinders and renewals of packing rings when the latter stood open 1-64 inch at the smallest part of the cylinder.

Mr. Hutchins emphasized the importance of using proper amount and quality of oil in the air cylinder, dwelling on the hard gum forming and holding the ring from expanding. He cited an instance where the air cylinder of a pump equipped with a swab had run without oil for two years.

Mr. Goodman had used valve oil in the air cylinder with better results than with any other kind of oil.

Mr. Alex. Brown explained that air cylinders were not supposed to run entirely without oil, but that the necessary oil should be introduced *via* the piston rod and swab if possible.

Mr. Weaver said that he had experimented with the oiling of the air cylinder, and cited at length the experiments. He decided that more harm was done from over-oiling than with insufficient oil. Mr. Weaver practiced renewing piston when the packing rings were renewed and the cylinder rebored.

Mr. Moore said that the practice on the Erie road was to make such repairs as the committee recommended. He endorsed the report of the committee.

Mr. Gill had found that groaning was nearly always traceable to the steam cylinder, and especially on engines where the joints in the pipe between the throttle and pump leaked.

Mr. Best believed that metallic packing on the piston rod reduced the number of hot pumps. Discussion closed.

Secretary Kilroy's report showed that the association now has 417 members, and has in the treasury $1,037.50.

Jacksonville, Fla., was selected as next meeting place.

The election of officers was as follows: President, W. F. Brodnax, Atlantic Coast Line, Richmond, Va.; First Vice-President, R. H. Blackall, Delaware & Hudson Railroad, Oneonta, N. Y.; Second Vice-President, T. H. Hedendahl, Union Pacific Railway, Omaha, Neb.; Third Vice-President, P. M. Kilroy, St. Louis, Arkansas & Texas Railway, Pine Bluff, Ark.; Secretary, F. M. Nellis, LOCOMOTIVE ENGINEERING, New York City. Executive Committee: R. H. Cory, Delaware & Hudson Railway, Green Island, N. Y.; F. E. Cross, Plant System, Savannah, Ga.; J. E. Goodman, Northern Pacific Railway, St. Paul, Minn.

Convention adjourned to meet first Tuesday in April, 1900.

New Air Whistle and Bell Cord Signals.

The air whistle or bell cord signals, as adopted by the American Railway Association at its convention in Detroit, Mich., April 11th, are as follows:

Two while standing is the signal to start.

Two while running is the signal to stop at once.

Three while standing is the signal to back.

Three while running is the signal to stop at next station.

Four while standing is the signal to apply or release brakes.

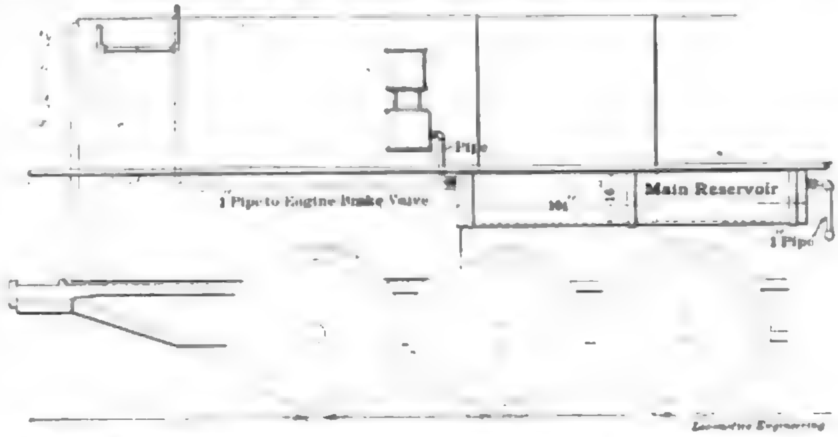


FIG. 5. SIDE VIEW OF SYSTEM OF PLACING TWO LARGE MAIN RESERVOIRS UNDER THE RUNNING BOARD OF A FREIGHT LOCOMOTIVE.

Four while running is the signal to reduce speed.

Five while standing is the signal to call in flagmen.

Five while running is the signal to increase speed.

Hand or lantern swung horizontally in a circle when the train is standing is the signal to apply brakes, and when held at arm's length above the head when the train is standing is a signal to release air brakes.

Railroad Schools.

The *New York Sun* says:

"On the railroad, men go to school all their lives. They never get too old to go. Whenever there comes into use any innovation that requires technical knowledge, such as the air brake, the men are divided into squads and sent to division headquarters for special instruction. These places are known among railroad men as "schools." The methods employed combine those in use in the kindergarten, the primary department, and the high school.

"Perhaps the most interesting railroad school is the car sent out by the Westinghouse Company to confer upon railroad men the final degree in the process of learning the air brake. The car is in charge of competent lecturers, and every railroad employé who has anything to do with the actual handling of engines or cars is required to attend.

"The men who conduct these lectures speak the vernacular of the railroad, and their talk is not always a model of good grammar and rhetoric; but what they say is practical and easily understood. Moreover, the men feel that the lecturer has actually sat in an engine and gone down a long grade with a heavy train, or that he has crawled around on the ground to fit hose. After the lecture is over the class passes into another car and is examined. There is something strangely familiar about the way the big-bearded fellows hitch their shoulders and wriggle when they are called upon to recite."

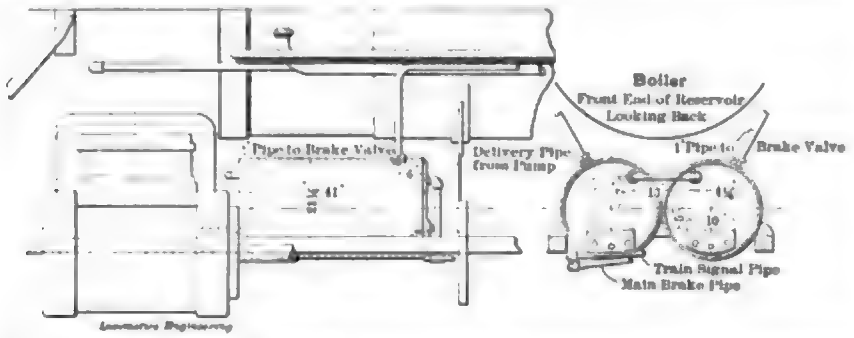


FIG. 6. MAIN RESERVOIR SYSTEM RECOMMENDED FOR EIGHT-WHEEL PASSENGER ENGINE.

CORRESPONDENCE.

Accidental Closing of Angle Cocks.

Editor:

A case of an angle cock becoming accidentally closed on a freight train on which the writer was traveling a short time ago, might be worthy of mention in your journal.

Brakes were all cut-in and tested properly before starting, there being about two-thirds air-braked cars in train. When using the brake in making a station stop along the line, the engineer noticed that there was a very decided difference in the holding power of the brake, to what it had been in previous stops. Upon an examination of the train by trainmen, it was found that an angle cock had become closed on front end of third car from engine, which happened to be of a foreign refrigerator line. The cock was opened, and the cause for its closure could not at that time be discovered.

The train proceeded, and when stopping at another station the same cock was again found closed. The car was now carefully examined, and the cause of closure was found to be, viz., that the pipe clamp at that end of car was missing, and the angle cock was turned so that the axis of cock-key was about 40 degrees from the perpendicular. When the car was in motion the vibration of pipe allowed the highest point of key to strike against an iron plate on dead wood. The blow would slightly slacken key in cock casing, and the handle being affected by gravitation, would, each time a blow was struck, give the key a slight turn before the spring had fully borne it back to its tighter bearing. The top part of handle that fits square of key was noticed to be bright, and by springing the pipe with the hand, till the bright place struck the deadwood, it was found that in eight blows the cock was shut.

The above would not only support the long-standing rule to car inspectors, of renewing missing pipe clamps, but it would seem to suggest that the turning of the angle cock on pipe, so as to give the hose an incline toward that on the other car, thus altering the vertical position of cock key, takes from the value of the angle cock, with regard to safety, as a train-pipe cock, and that it would be better to rigidly stick to what has been understood as the valuable features in the angle cock, viz.: "The cock-key standing vertically, the cock is not likely to be closed by gravitation, and the handle being in line with pipe and close to it, is thereby protected from flying missiles." Any inclination required for the hose could be given by making the cock casing sufficiently angular in that direction as well as downward.

C. R. Ord,
Genl. A. B. Insp., Can. Pac. Ry.
Toronto, Can.

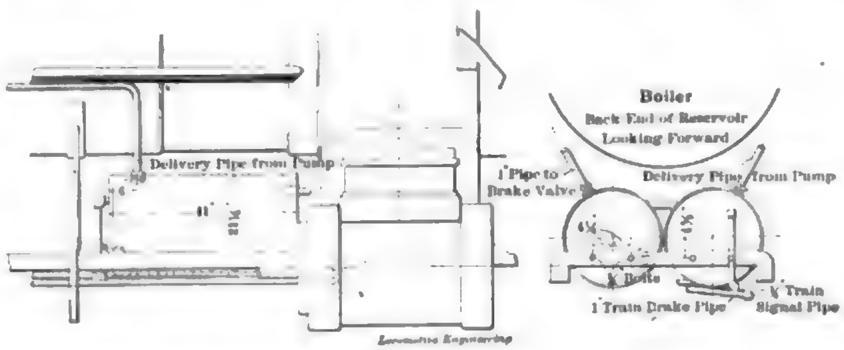


FIG. 7. BEST ARRANGEMENT OF MAIN RESERVOIRS ON AN EIGHT-WHEELED PASSENGER ENGINE. OBSERVE THAT CLEAN AIR IS OBTAINED BY PUMPING INTO ONE RESERVOIR AND USING OUT OF THE OTHER.

An Old Form of Equalizing Valve.

Editor:

I wish you would describe in your air-brake columns a brake valve I recently ran across in some old brake material, of which the following is a description, as near as I can give it.

I take it to be one of the first D-8 valves made, although Westinghouse instruction books give no information in regard to it. The rotary valve has only one large port in it, and in full release position air from main reservoir is pumped direct through large port in rotary seat into cavity *D*. Piston 17 has six ⅛-inch holes in it, and on under side has a sleeve in which is a spring to hold sleeve up against under side of piston. Now in order for air to pass from main reservoir to train line, it must force this sleeve from its seat on under side of piston 17.

In running position you have the same ports as in the later D-8 valve, only instead of air, after it has passed the excess spring, being pumped into train line direct, it is pumped into cavity *D* above piston 17, then through holes in piston 17 to train line. Now, what is the use of the excess pressure valve if it takes a certain amount of air in main reservoir to force this sleeve from its seat before air can get to train line? Also, I cannot see that cavity *C* in rotary valve has any service to perform except in an emergency application of brakes.

Now I suppose a reduction above piston 17 will allow spring to force sleeve up against under side of piston, closing the holes, when train-line pressure will raise piston and allow train-line pressure to escape to atmosphere. I have asked a

number of old-timers about this valve, but they all say it is the first one they ever saw. Wish you would please explain the principle of its operation.

Wm. D. Hitchcock.

San Marcial, N. Mex.

[This is one of the first forms of the equalizing discharge brake valves, and only a few of them were put out by the Westinghouse Air-Brake Company, the D-8 being a great improvement. This valve was catalogued as C-7, and was described in the Air-Brake Men's 1895 Proceedings, now out of print. The spring in the "sleeve" was very weak, merely supporting the weight of the sleeve. Gum and dirt interfered with the operation of the "sleeve" or cup, therefore demanding a better arrangement. The D-8 was the result. Your description and understanding of the valve are correct.—Ed.]

SENT BY A CORRESPONDENT WHO WRITES "A MODERN (?) AIR TESTING PLANT AND A SUGGESTION FOR A PAINTING ENTITLED 'CRUELTY TO ANIMALS.'"

Locating and Reporting Air-Pump Troubles.

Editor:

Having been put to much extra work by engineers failing to report fully the action of their air pump, I should like to offer a few suggestions which may be of some value and save hours of work in repairing them.

Many engineers simply report "Examine air pump; it will not work." If the engineer will note how his pump acts, and mention the actions, it will in nine cases out of ten enable the repairman to remove the difficulty in five minutes, where otherwise it would take much time to locate. For instance, when a pump is taking half strokes, how easy it would be to put that in the report, then the repairer could find the trouble at once.

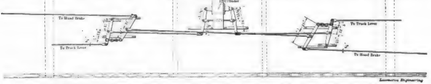
I would suggest that engineers find the man who does the repairing, explain to him how the pump is working, and then the repairman in return tell the cause for the action. During spare moments, the engineer should watch carefully the repairing of pumps, and never be afraid to ask questions, thereby learning many things which may be of use and value to them when miles away from the repair shop. In this way he may become a second Tom Jennings and save the company many dollars.

During my experience as a repairman, I have been called upon to repair pumps that have had to give up their trains on account of the pumps failing to work, thus causing a great delay and incurring much expense. After looking over these pumps I have found only a few faults, which could easily have been overcome by the engineer. A bent reversing stem (put in by a careless workman) will sometimes cause a pump to take only part of a stroke; a loose reversing plate refuses to allow the pump to reverse; or a jam nut off the piston rod will cause the same action. By putting a small burr with a chisel at each corner of the reversing plate bolts you will insure safety from their working loose.

I have noticed on a certain class of our engines that the steam pipe to pump makes a very convenient step for men working on the top of the boiler, and by so using it they form a basin in the pipe where the oil stays, and allows the pump to run dry and stop. Then the pump is blamed. I also find some engineers persist in running with their drain cocks wide open. How any man can expect to oil the ties and the pump at the same time is a mystery to me.

These drain cocks are of vital importance, and even if small and simple looking, they should not be neglected. A case happened a few days ago on this system where an engineer failed to use them at the proper time, and the result was a 9½-inch steam cylinder had to be sent to the scrap yard. When engines are left outside during cold weather, the drain cocks must be left open. This the engineer did not do; the water froze and cracked the steam port.

These are only a few of the many things that cause air pumps to fail in their duty, and I think engineers and firemen should make as thorough a study of their pumps as they do the rest of the brake, and by



STANDARD PASSENGER CAR FOUNDATION BRAKE RIGGING OF THE ATCHISON, TOPEKA & SANTA FE RAILWAY FOR OPERATING HAND BRAKES AND AIR BRAKES IN CONJUNCTION.

so doing cut down the expense of running their engines considerably.

JAMES BLEASDALE, JR.,
Chicago & Grand Trunk Ry.
Port Huron, Mich.

Supply Valve for Double-Heading Engines.

Editor:

I am sending you drawing and explanation of an automatic cut-out valve to be used when double heading, to allow both

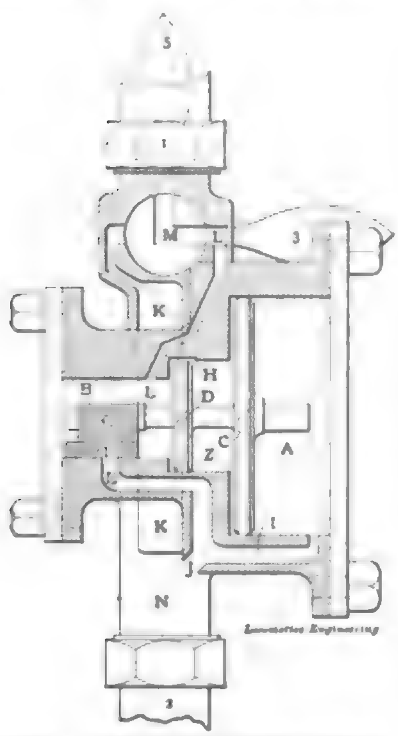


FIG. 1. AUTOMATIC CUT-OUT COCK FOR DOUBLE-HEADING.

pumps to pump air to train line. The valve is to be coupled to the train line below engineer's brake valve, at 1, and train line attached at 2. Air passes down through valve at *M*, a port in three-way cock, to port *L* and chamber *B*, through port *F* in slide valve *G*, to port *E*, entering train pipe at *J*, and chamber *A* through port *I*. At the same time air passes through small port *H* to chamber *Z*, equalizing pressure on both sides of pistons *D* and *C*.

When an application of air is made from the leading engine, the pressure is reduced in chamber *A*, and the pressure in chambers *Z* and *B* will immediately move pistons *C* and *D* and the slide valve forward, closing ports *E* and *F* and *H*. The port *H* being so very small, there will be very little loss of pressure in chamber *Z* before port *H* will have been closed by piston *D* traveling by it, confining the pressure in chamber *Z*. This cuts out the second engine until such time as the brakes are released from the leading engine, when pressure will act on piston *C* in chamber *A*, suddenly moving it back in position shown in cut.

When running single engine, the handle is turned to position shown by dotted lines in Fig. 2, when air will pass down through port *K*, entering train line at *N*.

I see so many improvements offered in your paper, and hope you will publish this, so that if anybody has any criticisms to offer, I may be able to remedy the defects and make the device perfect.

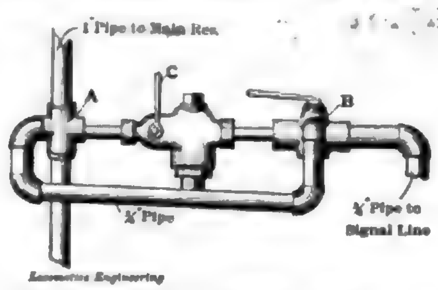
GEORGE H. WOOD,
Loco. Fireman, A., T. & S. F. Ry.
Argentine, Kan.

Arrangment for Double-Heading Engines.

Editor:

The article in February issue of LOCOMOTIVE ENGINEERING regarding the "special piping arrangement" as used on the Chesapeake & Ohio Railway, brought to my mind, Why not use the signal line to connect reservoirs on "double-headers"? In this section of the country it has been demonstrated that good service cannot be obtained by having main reservoir on the tender, and consequently we have to find some other location.

On a great many roads "double-heading" is an uncommon occurrence, and is done only when some difficulty arises, when the single engine cannot handle her regular tonnage on train. Such roads, I



PLAN SUGGESTED FOR UTILIZING SIGNAL LINE TO CONNECT THE MAIN RESERVOIRS OF BOTH ENGINES IN DOUBLE-HEAD TRAIN.

assume, would not feel warranted in equipping engines as per Chesapeake & Ohio arrangement and maintaining a separate line of pipe and hose. The arrangement of which I speak, and of which I enclose a rough sketch, while perhaps not perfect in every respect, I think will enable the second engine to maintain her position as "assistant." The engines must be equipped with signal apparatus with pipe leading to front end of engine as well as rear end. The signal reducer must be in cab and connected with reservoir pipe leading to engineer's valve at *A*. This connection is made at a double tee or cross-over, the opposite side of tee being for ¾-inch pipe; this ¾-inch pipe leading to three-way cock at *B*. The signal reducer must be supplied with handle *C* for cutting out, thereby making it more convenient for engineer.

E. O. PALMER.
St. Albans, Vt.

The souvenir key-rings and guest's badges presented by LOCOMOTIVE ENGINEERING to the Detroit convention were popular and called forth many complimentary remarks from the members.

The discussion of the Air-Brake Men showed that the independent brake attachment was valuable for holding slack in after brakes had been released, and not for gathering slack before the train brakes were set.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(34) H. L. H., Pensacola, Fla., writes:

I have the same trouble with the plate D-8 brake valve as before, equalizing piston remaining up, and sometimes with a short train, or the engine, the exhaust through the preliminary port will not stop until jerking the handle in emergency position several times. Could the trouble possibly lie in the brake valve? A.—Either dirt works under your rotary valve or the rotary mounts a ridge worn in the seat or valve face. However, should you mean that air escapes at the train pipe exhaust instead of the preliminary exhaust, the equalizing piston-packing ring may be too tight and stiff, or in need of oil.

(35) J. C. L., Jamestown, N. D., writes:

1. How much air pressure per square

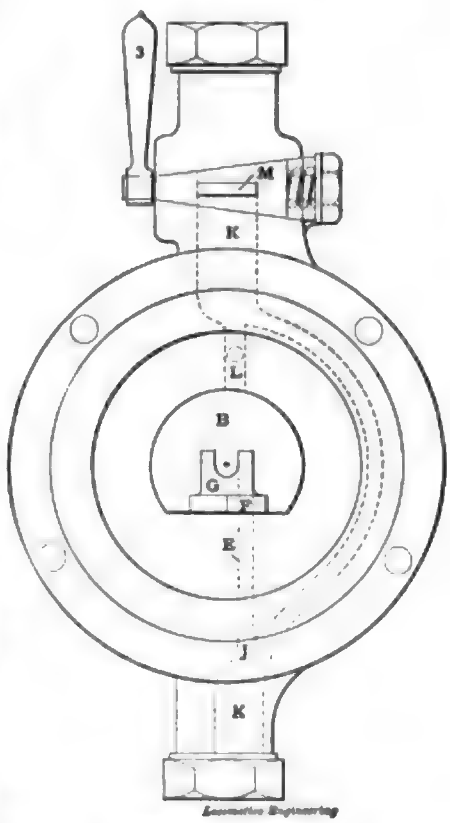


FIG. 2. AUTOMATIC CUT-OUT COCK FOR DOUBLE-HEADING.

inch at all times is there in cavity *y* in the quick-action triple valve? 2. How does it get there at all times? 3. How much resistance has check-valve spring 12, or has it any resistance? This has caused a great deal of argument in our air-brake room.

A.—1. When brakes are off, or are being charged or recharged, the pressure in chamber *y* is equal to that in train pipe minus the resistance of the spring 12 under compression. A.—2. When brakes are being charged, recharged or are off, chamber *y* gets air from the train pipe. Should the brakes be applied 10 or 15 pounds in service, and the check valve be perfectly tight, chamber *y* would merely hold its own pressure, receiving no additional pressure from any source. However, should an emergency application be made, and the train-pipe pressure be drawn low, and the check valve leak, pressure in chamber *y* would be replenished by that in the brake cylinder and auxiliary reservoir. A.—3. The resistance varies a little, but may be gotten exactly by attaching an ordinary small hook scale to the check valve in a sectional triple.

(36) H. L. H., Pensacola, Fla., writes: I have a 6-inch air pump that worked thus: On admitting sufficient steam to start it, it made the downward stroke all right, but the upward one was very slow until nearly at its end, when it reversed itself correctly, but repeated its lame motion on the upper stroke. Upon examining I found the packing rings in the reversing piston, upper and lower main valve, to fit nicely, and the reversing valve and rod were in good condition. The air valves were not broken nor stuck, having their proper lift and air passages clear. It has been running in this way for three days, when it suddenly sobered up, and is now working like a new pump. I didn't make any alterations or repairs, only examined as above. Please explain the cause. A.—Since the examination proved the air valves and air passages all right and the reversing mechanism all right, the trouble must have been some obstruction to the entrance of steam to the under side of main piston or exhaust from top side. This obstruction may have been a piece of gasket or other foreign substance which worked out suddenly. Sometimes failure to give sufficient clearance to bottom corner of reversing slide valve blocks the entrance of steam to the head and makes a slow upstroke; but this trouble would not disappear suddenly unless the corner was filed off.

Fifty-eight per cent. of the freight cars in the State of Michigan are equipped with air brakes.

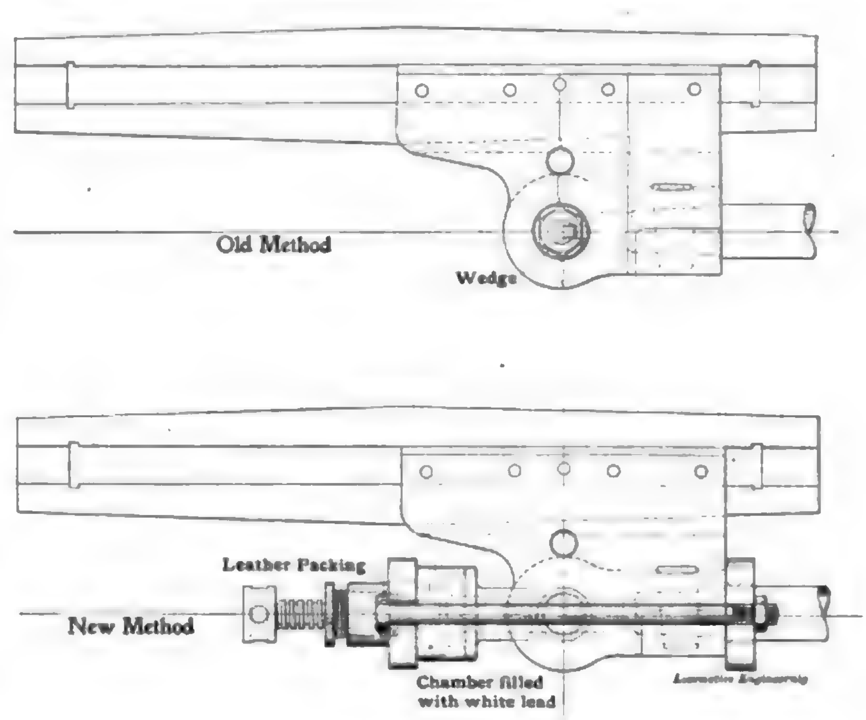
Mr. Andrews said that all engines on the New Haven road have a gage on the driver brake, and excellent results were had.

A member in the convention said he believed that a gage on the cylinder is the only proper solution of maintaining driver brakes.

We are informed that the Pittsburgh & Western has just completed a new air-brake instruction car, which will be placed in charge of Mr. Thompson, air-brake instructor and traveling engineer of the line.

An example of careless piping was observed on an engine recently coming from the shop, where eleven elbows, three unions and one tee in the pipe connection between the triple valve and driver brake cylinders were found.

Mr. Miller, superintendent of motive power of the Michigan Central road, in a speech before the Air-Brake Men's convention, got off the following witticism: "A locomotive has two habits considered bad in a man. It smokes and drinks."



PISTON-ROD REMOVER.

Piston-Rod Remover.

We show with this a piston extractor which was designed by Mr. John R. Gould, of Richmond, Va., to replace an old extractor, a sketch of which is also shown. The new extractor was designed with the intention of relieving the cross-head of the destructive stresses produced by the old one, which often resulted in fracturing cross-head at one or more of the places indicated.

The old extractor was simply an old cross-head wrist-pin, grooved out and fitted with taper key, fitting piece, nut and washer as shown in sketch, and with the assistance of a 12-pound sledge hammer, you were sure to either remove the piston or break the cross-head.

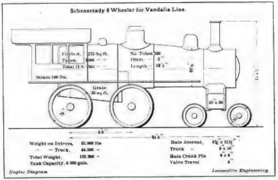
The new extractor consists of a cylinder piston, ram, displacing screw, two washers, leather packing, packing nut, etc., as shown in sketches. To operate, first fill chamber or cylinder with white lead, withdraw displacing screw until end is flush with bottom of leather packing, place extractor in position as shown in sketch, and draw up firmly the nuts on long bolts. Now with a steel bar about 3 feet long run in displacing screw, which will compress the white lead and create an enormous pressure (about 36,000 pounds per square inch, allowing 40 per cent. for friction) in cylinder, which acts on the four in piston or ram and forces the piston rod from cross-head, which is done without putting injurious stresses on the cross-head. As will be seen, the side bolts go each side of the cross-head, and simply put a compressive strain on it, instead of a local strain at pin-hole.

This has been in use in the Chesapeake & Ohio shop for a year and a half, and has given good satisfaction.

Correspondence instruction in technical subjects was instituted by The International Correspondence Schools, of Scranton, Pa., and its students and graduates, which now number more than 80,000, have ranked with, and in some branches have surpassed, students and graduates of other technical schools. They teach mechanical, electrical, steam and civil engineering, mechanical and architectural drawing, architecture, plumbing, English branches, bookkeeping, etc., having more than fifty courses. Students may study at home, devoting such time as they can spare, and the instructors are in constant communication with them through the mails. These schools have been endorsed by leading engineers, and graduates from them are always in demand.

Vandalia Express Engines.

The annexed engraving shows one of four heavy express passenger locomotives recently built for the Vandalia line by the Schenectady Locomotive Works. The engines are in service pulling heavy fast express trains between Indianapolis and St. Louis, and they are gaining a high reputation for the efficient way in which they do the required work. The engines were built under the direction of Mr. W. C. Arp, superintendent of motive power, and we understand that they went into service with exceptionally small trouble from the annoyances common to the breaking-in process. The Vandalia line is noted for the large mileage made by its passenger engines, and we expect in course of time to tell about the great mileage made monthly by these engines. The principal dimensions are:



VANDALIA EXPRESS ENGINE.

Weight in working order—132,300 pounds.

Weight on drivers—85,800 pounds.

Wheel-base, driving—8 feet 6 inches.

Wheel-base, rigid—8 feet 6 inches.

Wheel-base, total—24 feet 5 inches.

Diameter of cylinders—20 inches.

Stroke of piston—26 inches.

Horizontal thickness of piston—5¼ inches.

Diameter of piston rod—3¼ inches.

Kind of piston packing—2½-inch C. I. rings.

Kind of piston-rod packing—United States.

Size of steam ports—18 x 1⅝ inches.

Size of exhaust ports—13 x 3 inches.

Size of bridges—1⅜ inches.

Kind of slide valves—Allen-American.

Greatest travel of slide valves—6 inches.

Outside lap of slide valve—1⅛ inches.

Inside lap of slide valves—Line and line

Lead of valves in full gear—Line and line full forward motion, ¼-inch lead at 6-inch cut-off.

Kind of valve-stem packing—United States.

Diameter of driving wheels outside of tire—78 inches.

Material of driving-wheel centers—Cast steel.

Tire held by—Shrinkage.

Driving-box material—Phosphor bronze.

Diameter and length of driving journals—8¾ inches diameter by 11½ inches.

Diameter and length of main crank pin journals—6 inches diameter by 6 inches.

Diameter and length of side rod pin journals—4½ inches diameter by 4 inches.

Engine truck, kind—Four-wheel, rigid center.

Engine-truck journals—6 inches diameter by 10 inches.

Diameter of engine-truck wheels—36 inches.

Kind of engine-truck wheels—McKee-Fuller, steel-tired, spoke wheels.

Boiler, style—Extended wagon-top.

Outside diameter of first ring—62¼ inches.

Working pressure—190 pounds.

Material of barrel and outside of firebox—Coatesville steel.

Thickness of plates in barrel and outside of firebox—⅝, 11-16 and ½ inch.

Horizontal seams—Butt joint, sextuple riveted, with welt strip inside and outside.

Circumferential seams—Double riveted.

Firebox, length—108¼ inches.

Firebox, width—40 inches.

Firebox, depth—Front, 75¼ inches; back, 61¾ inches.

Firebox, material—Carbon steel.

Firebox plates, thickness—Sides, 5-16 inch; back, 5-16 inch; crown, ⅜ inch; tube sheet, ½ inch.

Firebox, water space—Front 4 inches; sides, 4 inches; back, 4 inches.

Firebox, crown staying—Radial, 1-inch diameter.

Firebox staybolts—7/8 and 15-16 inch diameter.

Tubes, material—Charcoal iron, 120 inches thick.

Tubes, number of—320.

Tubes, diameter—2 inches.

Tubes, length over tube sheets—12 feet 5 inches.

Heating surface, tubes—2,066 square feet.

Heating surface, firebox—175 square feet.

Heating surface, total—2,241 square feet.

Grate surface—30.07 square feet.

Exhaust pipes—Single.

Exhaust nozzles—4 3/4 inches, 4 7/8 inches, 5 inches diameter.

Smoke stack, inside diameter—17 1/2 inches at top, 16 inches near bottom.

Smoke stack top above rail—15 feet 4 7/8 inches.

Boiler supplied by—Two injectors, Sellers improved, 9 1/2 R. H., Monitor No. 9 L. H.

Weight of tender, empty—46,200 pounds.

Wheels, number of—Eight.

Wheels, diameter—36 inches.

Journals, diameter and length—5 by 9 inches.

Wheel-base—17 feet 8 inches.

Tender frame—10-inch steel channels.

Tender trucks—Center bearing double I-beam bolster, with side bearings on back truck.

Water capacity—6,000 United States gallons.

Coal capacity—10 tons.

Total wheel-base of engine and tender—52 feet 2 1/2 inches.

Engine equipped with two Coales safety valves; Nathan & Co. No. 9 triple sight-feed lubricator; Westinghouse-American combined brakes on drivers, tender and for train; Leach sand-feeding apparatus; Janney coupler at front of engine and rear of tender; steam-heat apparatus, complete, for tender and train; laggings and jacket made removable over staybolts.

The Horwich Shops of the Lancashire & Yorkshire Railway—II.

BY F. J. MILLER, in *American Machinist.*

(Continued from April number.)

Fig. 18 shows a machine which is one of the boldest conceptions of the milling machine idea in existence. I do not know who is to be credited with the origination of it, for in the older shops at Crewe I saw machines essentially like it at work, and, later, at the great establishment of the Cockerill Company at Seraing, Belgium, I saw a machine embodying the same principles and which had been constructed in that establishment many years before for doing the same work. We have no use for such a machine here, because we do not do the work requiring it. The machine is for milling out the metal to form the cranks, and, roughly, the crank-pins also for the main driving axles of inside connected locomotives. Unfortunately the "setting out" plate in the foreground of Fig. 18 obstructs the view of the machine, but its general features can readily be made out. As these axles come from the forge the mass of metal which forms the two webs of a crank and the crank-pin is in one solid chunk, and, as our readers know, the usual practice in marine work is to drill through at the corners where the pin joins the webs and then slot out the piece, leaving the pin a more or less misshapen affair to be slowly reduced to form in the lathe. The large number of axles to be made all alike in locomotive work, however, justifies and in fact demands something better than this. The machine consists essentially of a bed having a head and a footstock between which the forging is swung on centers with suitable fixtures for the off-set and can be given a rotary feed motion when required. At the rear of the headstock (though in front of it in the view shown) is a swinging frame of very massive proportions, pivoted below as shown, carrying the tremendous milling cutter spindle at the top and arranged to feed the inserted tooth mill toward the work by means of a screw which takes hold of the swinging frame at the top, as shown. When the work is at first put into the machine it does not rotate, but is held still in such a position that the milling cutter, being fed in, cuts out the slot forming the crank-webs, and this feed automatically stops when the

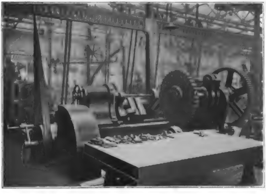


FIG. 18. HORWICH SHOPS, L. & Y. RAILWAY.

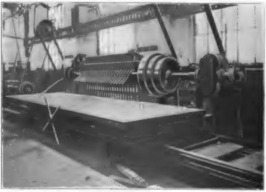


FIG. 19. HORWICH SHOPS, L. & Y. RAILWAY.

right depth is reached to leave enough metal to form the pin. The cutter arbor is then held in this position while the feed motion which revolves the axle on the centers, being thrown in, mills the pin so closely to size and shape that when the axle afterward goes to the lathe, only finishing cuts are required on the pins.

The inserted cutters resemble round nose planer tools and are given top rake, so that they may really cut, as, in fact, such tools usually do in European shops and not merely push off the metal as they usually do in our own shops. The machine, as may readily be imagined, is very efficient as compared with any other practiced method of removing the same metal.

Fig. 19 is a twenty-spindle drilling machine for drilling boiler plates before bending, no boiler plates being punched in this establishment. In position on the machine will be seen five boiler plates and a template by which they are drilled, and it will be noticed that, though the machine appears to have been originally planned to be driven by belt, it is now driven by a direct-attached motor seen at the right.

At Figs. 20 and 21 a special machine for tapping staybolt holes in fireboxes is seen. By means of this machine the four sides of the firebox can all be tapped at the same time. The machine is picked up by a crane, placed over a firebox, as shown, and fastened by bolts. Adjustable idlers permit a driving rope to be led from the nearest convenient pulley and each tapper is swung from a trolley, which permits free horizontal movement, while a system of counterweights takes care of the slack rope and permits the necessary vertical movement.

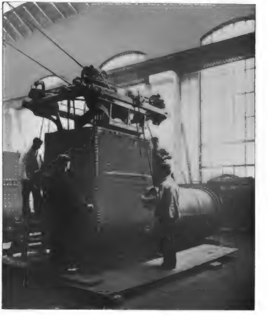


FIG. 20. HORWICH SHOPS, L. & Y. RAILWAY.

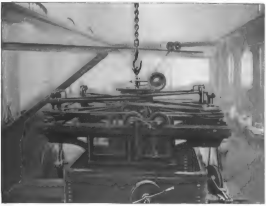


FIG. 21. HORWICH SHOPS, L. & Y. RAILWAY.

Fig. 22 shows the 400-ton hydraulic flanging press with the furnaces, and in the foreground some smokebox front plates that have been flanged.

(*To be continued.*)

A Young Admirer of "Locomotive Engineering."

The wife of one of our subscribers writes: "My little boy is so interested in LOCOMOTIVE ENGINEERING, although not six years. He is always anxious for the book to come, and when it comes he takes the book and explains the engines as if he were an old engineer; and when his papa tells anything about the engine, he listens, and can tell word for word. He declares he will be an engineer. I want him to be a doctor, but he says, 'No, mamma; I am going to be an engineer.' His name is Orlando Potter, and he lives at Sacramento, Cal."

Since commencing to equip their locomotive lubricators with the Tippett attachment for overcoming the back pressure, the Detroit Lubricator Company advise us that their trade in these devices has been very materially increased. They further state that many lines which formerly used other makes of lubricators exclusively are equipping their new engines with the Detroit lubricators with Tippett attachment, believing them to be more capable of meeting the requirements of the modern high-pressure locomotive than any other article of the kind.

British Opposition to Safety Appliances

The question of safety-car couplers is beginning to agitate the railway world of Great Britain just as it began to excite the attention of the American people about twenty-five years ago. The harvest of death that came from the killing of men engaged in the occupations that required them to couple cars, after very long suffering, roused the apathetic public opinion of America to demand a cessation of the human carnage. The people demanded that the coupling should be done in such a way that sacrifice of life and limb should no longer be a necessary concomitant of that work. The railroad companies with one accord replied that the general introduction of automatic couplers was impracticable; but inventors and leaders of humane sentiment insisted that the introduction of couplers that could be operated without danger to the switchmen was entirely practicable and merely a matter of expense, and the conflict between the conservative impulses of railroad management, and the awakened sentiment of human pity for death and suffering proceeded to engage in a struggle more worthy of interest and attention than any fight before recorded in the history of the world. The fights of the gods were mere trifles in comparison.

After protracted denials that a practicable solution of the automatic car-coupler problem was possible, the railroad companies referred the matter to the Master Car Builders' Association, to investigate what could be done, and incidentally to indicate that the railroad companies were open to conviction. After years of investigation and discussion the Master Car Builders' Association reported in favor of a certain type of automatic car coupler which could be operated without danger to the men engaged in the work of coupling and uncoupling cars, and in the course of time the Interstate Commerce Commission recommended to Congress that the adoption of that safety device should be made compulsory after a certain time, and laws were enacted which carry into effect that recommendation. Already the annual reports of the Interstate Commerce Commission prove that the introduction of this form of safety appliance has greatly reduced the destruction to life and limb among the men engaged in car coupling, and the indications are that when automatic couplers are applied to all cars, the accidents due to coupling and uncoupling will practically cease.

Pity for the army of men who annually go down to death in the British Isles while engaged in the unheroic occupation of coupling cars, has begun to manifest itself just as it began to stir the hearts of our people twenty-five years ago for the men who were victims in the same industrial conflict. In Britain the same condition of sentiment and selfishness that we witnessed is apparent. The railway employés and the public are demanding the introduction of automatic couplers, and the railway companies are declaring, with one accord, that the thing is impracticable. When the contending forces of selfishness and of humanity come into conflict, we have noticed that, in the long run, humanity tramples selfishness under its heel. It will be the same in this case, in the long run. When a mechanical appliance can be introduced which will reduce human suffering, the general introduction of that appliance is inevitable, be it the best form of continuous brake or the best form of automatic car coupler.

So far as safety appliances in train operating are concerned, America is the Greater Britain which the lesser must follow eventually. In the end, all the powers of selfishness are futile to hurl back the agression of humanity. Nothing occupies the attention of our inventors of improvements in railway appliances so much as the producing of means for reducing the danger to the traveling public and to those who serve that public. Every advance which we make in this line must in the long run be adopted by all civilized countries. The British railway managers who are opposing the introduction of automatic couplers are merely marking time.

FIG. 22. HORWICH SHOPS, L. & Y. RAILWAY.

The Meriden Machine Tool Company, Meriden, Conn., have issued a special European edition of their "Story Without Words." It's a neat little booklet and shows several interesting tools, as well as gives a number of apt illustrations.

The mechanic is making rapid strides in the navy these days. There are to be 100 warrant machinists, which makes officers of them. Pay will range from $1,200 to $1,800 per year, and they will have separate quarters from the enlisted men.

PERSONAL.

Mr. W. S. Templeton has been appointed general foreman of the Southern Pacific at Bakersfield, Cal.

Mr. C. M. Harrison has been appointed superintendent of the Jamestown & Chautauqua at Jamestown, N. Y.

O. De Young, master mechanic of the Galveston, Harrisburg & San Antonio at El Paso, Texas, died on March 24th.

Mr. John Vought has been appointed master mechanic of the Lehigh Valley at Hazleton, Pa., to succeed Mr. F. Roth, resigned.

Mr. Garret Vliet has been appointed master mechanic of the Grand Trunk Railway at Gorham, N. H., vice Mr. Frank Joy, resigned.

Mr. F. Horton has been appointed superintendent of the Des Moines Northern & Western at Des Moines, Ia., vice Mr. J. F. Gibson, resigned.

Mr. Frank Ray has been appointed road foreman of engines of the Pennsylvania at Fort Wayne, Ind., to take the place of A. H. Polhemus, deceased.

Mr. N. L. Mewhinney has been appointed general foreman of the Alabama Great Southern at Birmingham, Ala., in place of Mr. W. Smitley, resigned.

Mr. G. L. Warren, for the past fifteen years chief draftsman for the Chicago, St. Paul, Minneapolis & Omaha, has been appointed mechanical engineer.

Mr. G. U. Biser has been appointed car foreman of the Fort Worth & Denver City at Fort Worth, Texas, taking the place of Mr. B. T. McClellan, resigned.

Mr. U. C. Hugiston, formerly engineer on the Cheshire branch, has been appointed traveling engineer of the Cheshire branch of the Fitchburg Railroad.

Mr. H. T. Bentley, general foreman of the Chicago & Northwestern at Clinton, Ia., has been promoted to the position of master mechanic at Baraboo, Wis.

Mr. J. Fleisher has been appointed master mechanic at Eagle Grove, Ia., of the Chicago & Northwestern. He was previously general foreman at Winona, Minn.

Mr. James Oborne, assistant to the vice-president of the Canadian Pacific, has been appointed general superintendent of the Western division, with office at Winnipeg, Man.

The office of division master mechanic on the Colorado & Southern at Denver, has been abolished, and Mr. J. Piccioli has been appointed general foreman at Denver, Colo.

Mr. N. J. Pritchard has been promoted from the position of foreman of machinery to that of master mechanic on the Hutchinson & Southern Railway at Hutchinson, Kan.

Mr. J. H. Pennington has been appointed superintendent of motive power of the Delaware, Susquehanna & Schuylkill at Drifton, Pa., in place of John R. Wagner, deceased.

Mr. R. A. Dugan, purchasing agent of the Elgin, Joliet & Eastern, has been appointed purchasing agent of the Chicago, Lake Shore & Eastern also, in place of Mr. L. D. Doty.

Mr. Wm. Hutchinson, master mechanic of the Chicago & Northwestern at Eagle Grove, Ia., has been transferred to Winona, Minn., to take the place formerly held by Mr. W. McIntosh.

Mr. B. P. Holland, general superintendent of the Norfolk, Virginia Beach & Southern, has been appointed general manager, with headquarters at Norfolk, Va., vice Mr. W. T. McCulloch, resigned.

Mr. B. T. McClellan, foreman of the car department of the Fort Worth & Denver City at Fort Worth, Texas, has resigned to become general foreman of the Illinois Central at New Orleans, La.

Mr. L. Stewart, train master of the Chesapeake & Ohio at Lexington, Ky., has resigned to accept the position of superintendent of the San Antonio & Gulf, with headquarters at San Antonio, Texas.

Mr. G. W. Dixon, roadmaster of the Pittsburgh, Lisbon & Western, has been promoted to the position of master mechanic of that road at New Galilee, Pa., vice Mr. Richard Beeson, resigned.

Mr. John Forster, recently appointed master mechanic of the Colorado & Southern, has been promoted to the position of superintendent of motive power at Denver, Colo., vice Mr. J. S. Turner, resigned.

Mr. E. J. Mulaney, formerly engineer on tunnel division of the Fitchburg Railroad, has been appointed traveling engineer of the Eastern division of the Fitchburg Railroad between Boston and Fitchburg.

Mr. A. C. Deverall, superintendent of the St. Cloud shops of the Great Northern, has been promoted to the position of superintendent of the car and machine shops at St. Paul, vice Mr. S. F. Forbes, promoted.

Mr. W. H. Stocks, master mechanic of the Eastern Iowa division of the Chicago, Rock Island & Pacific, has been transferred to the Illinois division, with office at Chicago, Ill., in place of Mr. A. L. Studer, promoted.

Mr. Theodore Haberkorn has been appointed master mechanic of the Kenova shops of the Norfolk & Western. He was formerly connected with the motive-power department of the Pittsburgh, Fort Wayne & Chicago.

Mr. A. O. Williams, train master of the Columbus, Sandusky & Hocking at Columbus, O., has resigned to accept the position of superintendent of the Seattle & San Francisco Railway & Navigation Company at Seattle, Wash.

Mr. D. C. Moon, superintendent of the Dunkirk, Allegheny Valley & Pittsburgh, has resigned to accept the position of superintendent of the Rome, Watertown & Ogdensburg at Watertown, N. Y., vice Mr. E. G. Russell, resigned.

Mr. R. D. Fiddler, general foreman of the Chicago, Rock Island & Pacific at Herington, Kan., has been promoted to position of master mechanic of the Eastern Iowa division at Rock Island, Ill., vice Mr. W. H. Stocks, transferred.

Mr. G. W. Bartlett, division engineer of the Eastern division of the New York Central, has been appointed superintendent of the Dunkirk, Allegheny Valley & Pittsburgh, with headquarters at Dunkirk, N. Y., vice Mr. D. C. Moon, promoted.

Mr. John B. McKim, train master of the Erie & Ashtabula division of the Pennsylvania, has resigned to accept the position of superintendent of the Western division of the Pittsburgh, Fort Wayne & Chicago at Fort Wayne, Ind., vice Mr. C. D. Law.

Mr. C. A. Seley, mechanical engineer of the Northern Pacific at St. Paul, Minn., whose writings are well known to our readers, has resigned to accept the position of mechanical engineer of the Norfolk & Western at Roanoke, Va., vice Mr. G. R. Henderson, resigned.

Mr. W. J. Wilgus, engineer of maintenance of way of the New York Central & Hudson River, has been appointed chief engineer of that road (headquarters at New York), vice Mr. Walter Katte, resigned. The office of engineer of maintenance of way has been abolished.

Mr. A. L. Studer, master mechanic of the Illinois division of the Chicago, Rock Island & Pacific, has been promoted to the position of assistant superintendent of motive power of the lines west of the Missouri River, with office at Horton, Kan., vice Mr. J. W. Fitzgibbon, resigned.

Mr. J. S. Turner, superintendent of motive power of the Colorado & Southern at Denver, Colo., has resigned to accept the position of assistant superintendent of motive power of the Fitchburg Railroad at Boston, Mass. He was formerly superintendent of motive power on the West Virginia Central & Pittsburgh.

Mr. J. T. Johnson, general superintendent of the Cleveland Terminal & Valley Railroad and superintendent of the Akron division of the Baltimore & Ohio, has been presented with a handsome diamond ring by the receivers of the Baltimore & Ohio, for services rendered on the Chicago division, in addition to his other duties during the heavy freight traffic in December.

Mr. E. W. Mortimer, an old-time engineer on the Great Northern Railroad, has been promoted to master mechanic of Fergus Falls division; headquarters at Melrose, Minn. He takes the place of Mr. T. E. Adams, who has been transferred to the Eastern Minnesota Railroad; headquarters West Superior, Wis. Both are old-time engineers of the Great Northern and fully capable of filling the position of

master mechanic. It also speaks well of Mr. Hill to promote his men from the ranks.

Mr. P. H. Brangs, electrician of the Delaware, Lackawanna & Western at Hoboken, N. J., has had his jurisdiction extended over all signals on the division.

Mr. J. W. Cloud is going to London as vice-president and general manager of the Westinghouse Air-Brake Company, Limited. Mr. R. W. Bayley, of the Pittsburgh office, will succeed Mr. Cloud at Chicago, and Mr. R. A. Parke, Eastern representative, will succeed Mr. Bayley. Mr. L. F. Purtill, at present assistant to Mr. Parke, will take charge of the New York office. It is understood that Mr. F. M. Nellis will enter the New York office when the college year is finished.

The annual meeting of the stockholders of the Joseph Dixon Crucible Company was held at the Company's main office, Jersey City, N. J., Monday, April 17th, and out of a possible vote of 7,345 shares, there were 7,069 shares voted for the reelection of the old board, consisting of Edward F. C. Young, John A. Walker, Daniel T. Hoag, Richard Butler, William Murray, Alexander T. McGill and Joseph D. Bedle. President E. F. C. Young, Vice-President and Treasurer John A. Walker, Secretary Geo. E. Long were reelected by the directors. Judge Joseph D. Bedle was also re-elected as counsel.

Mr. A. M. Waitt, who has been for seven years general master car builder of the Lake Shore & Michigan Southern Railway at Cleveland, O., has been appointed superintendent of motive power and rolling stock of the New York Central Railroad, succeeding Mr. Wm. Buchanan, resigned. Mr. Waitt is a graduate of the Massachusetts Institute of Technology, and entered railway service in 1879 as draftsman in the car and locomotive department of the Chicago, Burlington & Quincy. He was chief draftsman for two years of the Eastern Railroad of Massachusetts; then became general foreman of the car department, which turned him to the car side of railway service. He has always taken a very keen interest in locomotives, however, and has made several attempts to return to the locomotive department.

Mr. W. C. Hayes, of the Minneapolis & St. Louis Railway, has been appointed locomotive superintendent of the Baltimore & Ohio Railroad, with headquarters in Baltimore. The position he will fill is similar to that of general road foreman of engines. He will have charge of all the enginemen, traveling engineers, air-brake inspectors and others connected with the mechanical operation of trains. Mr. Hayes has been for years a locomotive engineer on the Minneapolis & St. Louis, and has been a very influential member of the Brotherhood of Locomotive Engineers, having been for several years a grand officer. He acted as general agent for LOCOMOTIVE ENGINEERING in the Minneapolis and St. Paul district, and did a great deal to spread its circulation there. He is a natural leader of men, and we anticipate that he will make a great success in his new position.

Mr. Ed. M. Sawyer, a well-known locomotive engineer on the Canadian Pacific, with headquarters at Winnipeg, Manitoba, has obtained six months' leave of absence to enter the employment of the International Correspondence Schools, at Scranton, Pa. He will travel with that company's car, and if he finds the duties congenial he will resign from the Canadian Pacific. Mr. Sawyer is chairman of the Grand Executive Board of the Brotherhood of Locomotive Firemen, and is a very influential member of that order. He is one of the best posted men concerning locomotive mechanism we have ever met, and is sure to be a valuable acquisition to the International Correspondence Schools. We were always surprised that the Canadian Pacific Railway Company did not find a higher position for him than that of running a locomotive.

In the retirement of Mr. William Buchanan from the position of superintendent of motive power of the New York Central, after serving the company for over fifty-two years, one of the most celebrated of our railroad mechanics withdraws to enjoy a well-deserved rest from harassing labors. Mr. Buchanan was born in Dumbarton, Scotland, sixty-nine years ago, and was brought to this country when a child. He began railway work in 1847, and passed through the grades of machinist apprentice, machinist, locomotive engineer, shop foreman and master mechanic. In 1881 he was made superintendent of motive power of the whole New York Central system, and a few years later his authority was extended over the car department, and at the time he resigned he had charge of the rolling stock of all the lines controlled by the New York Central. Mr. Buchanan invented several valuable improvements on railroad appliances, particularly on signals. His water-table firebox also gained some favor; but his principal success has been in the development of the high-speed locomotive. His courage in designing engines whose size and capacity were limited only by the height and width of tunnels led the way to the modern high-speed engine. Mr. Buchanan has been in delicate health all winter, and he received a peremptory order from his physician to retire from business, which led to his resignation.

The new edition of "Locomotive Engine Running and Management" promises to be as popular as it was when the book first appeared in 1885. The numerous firemen who are looking forward for promotion are displaying keen interest in the revised edition, and they say that the answers to the Traveling Engineers' standard examination questions are worth the price of the book.

EQUIPMENT NOTES.

Lehigh Valley Railroad have ordered 500 cars from the Buffalo Car Company.

St. Louis & San Francisco Railroad have ordered 200 cars from the St. Charles Car Company.

Chicago & Northwestern Railway have ordered 300 cars from the Terre Haute Car Company.

Huntingdon & Broad Top Railroad have ordered from the Jackson & Woodin Company 500 cars.

Dickson Locomotive Works are to build ten consolidated locomotives for the Delaware & Hudson Railroad.

Chicago Terminal Transfer Railroad have ordered 100 cars from the Illinois Car & Equipment Company.

Baldwin Locomotive Works are going to build five consolidated locomotives for the Atchison, Topeka & Santa Fé Railway.

Buffalo & Susquehanna Railroad have ordered two six-wheel connected locomotives from the Pittsburgh Locomotive Works.

Schenectady Locomotive Works have received an order from the Dominion Coal Company for two six-wheel connected locomotives.

Buffalo, St. Mary's & Southwestern Railroad have placed an order for 500 cars with the Michigan Peninsular Car Company.

Pittsburgh Locomotive Works have orders to build three six-wheel connected locomotives for the Cincinnati, Hamilton & Dayton Railway.

Brooks Locomotive Works have received an order for one consolidated locomotive for the Buffalo & Susquehanna Railroad, also one for the Rio Grande & Eagle Pass Railway.

Baldwin Locomotive Works have received orders for one six-wheel connected locomotive for Roane Iron Company, twenty consolidated locomotives for the Mexican Central Railway and twenty-five consolidated locomotives for the Pennsylvania Railroad.

The Baldwin Locomotive Works, Philadelphia, Pa., have received an order for sixty engines from the Indian Government. The company intends to complete the entire order in four months. Several of these engines will be used on the new railroad from India to Burmah.

Baldwin Locomotive Works are about to receive an order from the Ottawa, Arnprior & Parry Sound Railway for eight consolidated locomotives of the Vauclain compound type. They are to be equipped with Westinghouse brakes, "Diamond S" brake shoes, Gould couplers, Hancock inspirators, Crosby safety valves, Leach sanding devices, Detroit lubricators and Crosby steam gages.

One of our friends who don't smoke has a little tale of woe of his own, as follows: "I don't mind a man's smoking (might myself, if I could afford it and didn't get sick), but I do kick at a certain train I have to ride on quite frequently. It's a four-car train. First comes the baggage and smoker combined, then a parlor car, smoker No. 2 (which hasn't any sign, and you don't know it till you get into it), and then the "sit-up car," as the boys call it. Four cars, and only one of them for the women, children and poor, half-baked men like myself that don't know how to smoke. Don't seem just the right way to divide up; but p'rhaps I'm prejudiced."

The "Vulcan" and the "Infanta Maria Teresa."

Although the "Vulcan," the floating machine shop of the navy may not be strictly a railroad subject, it is a mechanical one, and is of interest to every shop man. Formerly the merchant steamer "Chatham," 40 feet beam, 265 feet long, she was fitted out at the Boston Navy Yard with all the appliances that seemed likely to be needed.

The equipment included an iron and brass foundry, pattern shop, forge shop, machine shop, tool room and a place for boiler work. Pig iron, copper, tin, lead and sand had to be carried for the foundry; lumber for the pattern shop; steel and iron of all shapes and sizes for the machine work, and stores of all kinds.

The foundry was a space 15 by 16 feet, and here was a 36-inch cupola and two brass furnaces. In order to prevent fire, all wood was removed from the deck here, asbestos board was laid down, and this covered with about 3 inches of cement. Under the cupola firebrick was used in addition, and the decks above were shielded by sheet metal and asbestos. Heats as heavy as 1,500 pounds were run from this cupola.

The machine shop had Gould & Eberhardt shapers, Brown & Sharpe milling machines, a Reed lathe, and a lot of old Navy Yard tools that had seen better days. The ventilating system installed by the B. F. Sturtevant Company was one of the few comforting features, from the men's standpoint.

Prof. W. S. Aldrich and Mr. Gardiner W. Sims, both of whom were officers aboard the "Vulcan," give some very interesting facts concerning their work in repairing the vessels of the fleet, as well as the "Infanta Maria Teresa" and the gunboat "Sandoval," afterward towing the "Teresa" until she was abandoned.

Although designed primarily to repair the steam-engine equipment of the fleet, the work of the "Vulcan" covered almost every part of the battleships and smaller vessels. They made a new battle-hatch for the "Iowa," to replace the one shot away by a stray Spanish shell, and this included putting in a new piece of deck and making the hatch combing of angle iron. They manufactured spare parts in quantity for nearly all the vessels, besides overhauling the "Sandoval" and putting her into service, as well as patching the holes in the "Teresa" preparatory to bringing her North.

It is interesting to note that they made no repairs for the "Oregon," Engineer Milligan's only order being for some spare parts to replace those used. This is a sidelight on the wonderful voyage of this noble battleship and the equally wonderful work of her engineers. When Commodore Melville thinks best to lay down the work he has carried on so well, we would suggest that Cnief Engineer Milligan be seriously considered as a successor.

The "Vulcan" not only did the repair work of the fleet—about seventy vessels being stationed in this vicinity—but actually fitted out Commodore Watson's fleet when it was expected to sail to Spain.

On November 1, 1898, the "Vulcan" started North with the "Teresa" in tow, having been in Cuban water just four months, and her shop working night and day most of the time. As is known, they ran into a hurricane and were obliged to abandon the "Teresa" on the 5th, after assisting in taking off the one hundred and fourteen men who were on her. In spite of the severe weather, not a man was lost, and the "Teresa" was driven ashore on Cat Island, where she lies today.

It is interesting to note that this is believed to be the island where Columbus first set foot, instead of Watling's Island, as has been claimed. The wreck of the Spanish cruiser, representing the final departure of Spain from this continent, ashore on the very threshold of their vast possessions of two centuries ago, can hardly fail to turn our thoughts toward the ultimate end of any nation which refuses to keep pace with the age. In regard to the "Teresa," it may soothe our feelings over her loss to know that it is the belief among naval engineers that it is better as she is. Although she appeared sound when they left Guantanamo Bay, the heavy weather seemed to open every joint, which was due to their being weakened by the shock of exploding shells and the straining caused by the fire on her. This being the case it is far better to have her on Cat Island without the loss of a man, than to have had her fitted out and go down with all on board because of her inability to weather a storm. As a matter of sentiment we wanted her; as a matter of business we are better off without her, and we are indebted to the peerless Dewey for our prizes of war in the shape of several gunboats he has had raised and fitted out.

In closing it is but fair to point out that to Commodore Melville is due the credit for fitting out the "Vulcan," which inaugurates a new departure in naval warfare. Never before has it been attempted to run a foundry or a regular machine shop at sea—yet both were entirely successful.

Without the facilities for repairing damage a fleet can make but one attack and then turn tail to reach home or sink, as the case may be. With a repair ship as part of the fleet, convoyed just as the colliers or supply vessels are, the repairs can be made in any fairly sheltered place, and operations resumed without a naval base.

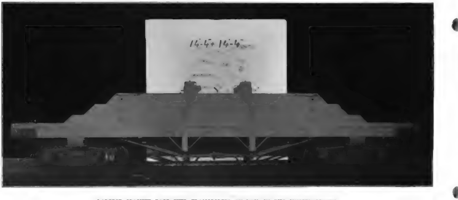
Practically the whole of the world's supply of platinum comes from Russia. Nearly all the important mines have passed into the hands of foreigners. According to a St. Petersburg newspaper, there is a group of mines concentrated in the Verkhotursk district of the Government of Perm, numbering about seventy, of which forty are being worked. In the course of last year several of these passed into the hands of foreigners, including a Paris syndicate having a capital of several million francs, and five out of the existing seven great platinum enterprises in the Urals are now reported to have been purchased by foreigners. There is said to be really no demand in Russia for the metal, and when Russians owned the mines they exported the ore in the rough state to be treated in Germany and other countries. The production of the mines in the Verkhotursk district amounted last year to about six tons. This may not seem a large quantity when we consider that platinum is the heaviest of the metals, excepting the still rarer metal, iridium, but it must be borne in mind that it can only be compared with gold in value. The price per ton was estimated, in connection with the purchase of some of these mines, by the Paris syndicate already referred to, at from £160,000 to £192,000.—*English Mechanic.*

A well-known railroad superintendent who has been exceptionally successful in the management of men, was asked why it was that contentment, harmony and loyalty prevailed on his division, while discord and numerous manifestations of friction and mutual dislike were apparent between officers and men on the other divisions. His answer was, "I have a recipe which I dose the men with pretty regularly. It consists of a mixture of one-half kindness and the other half firmness." We advise officials having trouble with their men to cut out this recipe and paste it in their hats.

The Crosby Steam Gage & Valve Company are making quite a point at present about the construction of their single-bell whistle on account of its durability and effectiveness.

A Special Granite Car.

The rather novel illustration shows a special car made for transporting granite. The base shown was sent from Barre, Vt., to Cincinnati, Ohio, on October 28th of last year, via the Montpelier & Wells River, Central Vermont, Ogdensburg & Lake Champlain, New York Central, Michigan Central, and Cincinnati, Hamilton & Dayton railroads. The extreme height from rail was 15 feet 1 inch, the base being loaded through the "well hole," as shown. The car is 36 feet long, 9 feet 2 inches wide, 4 feet 3 inches high, and weighs 41,000 pounds without the blocking, which adds 7,300 pounds to the car. The journals are 5½ by 9 inches; the six truss rods 2¼ inches in diameter, and the capacity 100,000 pounds. It is equipped with Westinghouse air brake, Tower couplers, and weighs, together with base, 100,980 pounds. The base alone weighs 52,680 pounds.



LARGEST GRANITE BASE EVER TRANSPORTED BY RAIL IN THE UNITED STATES.

The M. C. B. Coupler.

At the meeting of the Western Railway Club on April 18th, the question of the variation of the contour lines of the various makes of couplers was under discussion, in connection with the report of the committee. Several plans for a gage to show this variation were submitted. Mr. J. N. Barr had a design which was calculated to show whether the coupler had had a proper alignment with the shank. It was stated by several gentlemen present that it was not unusual to find couplers that have been sprung out of line when contracting while cooling off after casting or in annealing.

In this connection, would it not be well for manufacturers to test their couplers before delivery, and assure themselves that they are in line, so that they couple and uncouple properly.

Mr. G. W. Rhodes spoke of weak knuckles, and thinks the opening for the link is too wide, as it makes the knuckle too weak. He sent out for use on the Chicago, Burlington & Quincy a lot of knuckles for caboose cars, with an opening only 1½ inches wide. They are in service without any complaint of difficulty in using a link to couple to other cars. Some men are calling for a solid knuckle with no opening for a link, but Mr. Rhodes does not think the time has yet come for this change in the knuckle for general service. He defended the Master Car Builders' coupler, saying that long trains could not be handled safely with any other type of coupler.

The committee took a firm stand for the present contour lines; their report was received, adopted and referred to the Master Car Builders' Association's Committee on Couplers.

Good Workmanship.

In the elder days of art, builders wrought
with zealous care
Each unseen and hidden part, for the
gods see everywhere.

What constitutes good workmanship? The view of one portion of the community is well set forth in the couplet with which we have headed this article. Strictly defined and limited the principles there inculcated are highly commendable; but unless so restricted are likely to lead to what may almost be termed an immoral waste of labor. The scamping of work simply because it is concealed from easy inspection is one thing, but the application of labor to work, which adds neither to the beauty or efficiency of a structure or tool, is almost equally objectionable. In too many cases this consideration is unheeded. Mathematical instrument and model makers are especial offenders in this respect. It is almost impossible, in giving them an order for some experimental work, to get them to confine the energies of their men to finishing the really essential portions of the model, the usual excuse being that, if the mechanic finishes one part roughly, he is likely to make an equally rough job of the remainder. In a minor degree manufacturing engineers are guilty of the same fault, whilst others are able to combine the highest class of finish in the essential portions of a machine with a minimum of profitless labor elsewhere.

Some time ago we took to pieces one of the small drills driven by compressed air (Chicago pneumatic drill), which are now becoming so common. The examination thus made showed this piece of work to be, all things considered, one of the best examples of manufacturing engineering we have ever met with. For roughness of finish, certain of the concealed portions of the tool exceeded anything we had previously experienced, whilst the finish of the actual working parts was, on the other hand, as near perfection as is commercially possible. The pistons were ground dead true, and fitted their cylinders airtight, without requiring packing. The valve, which was of the rotating type, was finished in an equally perfect way. In short, throughout no soft packings were used, the moving parts fitting in their seats with such accuracy as to practically prevent all leakage. The gears, used in reducing the speed of the prime spindle to that of the drill spindle, had all cut teeth, and ran most sweetly; still, the filing on the crank cheeks, which fitted nothing, was absolutely the roughest we have ever met with in a finished article. The cheeks were, when the drill was in running order, absolutely concealed from view, and thus labor expended on finishing them would neither have added to the

efficiency or appearance of the tool. Good engineering, therefore, mindful of the fact that tools are built for human use, and not for gods with all-piercing eyes, quite rightly reduced to a minimum all labor on these hidden parts.

To take another instance, some enclosed engines of American make, we have observed, are supplied with connecting rods not even rough turned, but simply forged to size as near as may be. The eyes at either end, the crosshead pin and the crank pin are, on the other hand, most carefully finished. Here, again, the essential work is done in a thoroughly efficient manner, but the labor on the non-essential kept to its lowest limit. Such procedure, in our opinion, is far better engineering than the more usual custom of machining such rods all over. The forgings referred to above were excellent articles.

In fact, one of the advantages of executing work in this way, is that it educates smiths and molders to turn out their work with a good finish, independent of what may happen to it afterwards in the machine shop. Of course from some points of view work expended in beautifying an engine or machine is also profitless, but fortunately man does not live by bread alone, and indirectly there is a distinct gain in giving occasion for the exercise of the æsthetic instincts of engine drivers or machine attendants, who thereupon take a pride in their work. At one time this consideration led to the adoption of gothic moldings and other abortions in machine parts, and to a less reprehensible excess in use of machined and polished details.—*Engineering.*

The Locomotive for the Midland Railway.

We show herewith the first of the lot of locomotives built by the Baldwin Locomotive Works for the Midland Railroad of England. As will be seen they are a plain mogul of practically standard American practice, except the buffers and trimmings, which very properly conform to Midland practice, in fact, came from England to be put on.

Fireboxes and staybolts are copper, front and rear crank pins are flush with the rod, injectors feed direct into boiler head, stack has a brass top, and Gresham steam sanders are used front and back of the main drivers. The exhaust nozzles are high, and the blower is in the form of a casting surrounding the nozzle, the steam entering the side and being distributed through holes in the casting so as to give a central blast. The cab is roomy, and should be a surprise party to those accustomed to the small one generally used there. The screw reverse is also conspicuous by its absence. The tanks are not provided with scoops, but they have a large water space in proportion to coal room. They are neatly painted in the prevailing Midland color and present a fine appearance generally.

The main dimensions follow:

Cylinders:
- Diameter—18 inches.
- Stroke—24 inches.

Boiler:
- Diameter—56 inches.
- Thickness of sheets—5/8 inch.
- Working pressure—180 pounds.

Firebox:
- Material—Copper.
- Length—72 inches.
- Width—33¼ inches.
- Depth—76¾ inches.
- Thickness of sheets—½ inch.
- Tube sheet—¾ and ½ inch.

Tubes:
- Number—263.
- Diameter—1¾ inches.
- Length—10 feet 5¾ inches.

Heating Surface:
- Firebox—120 square feet.
- Tubes—1,246 square feet.
- Total—1,366 square feet.
- Grate area—16.7 square feet.

Driving Wheels:
- Diameter, outside—60 inches.
- Journals—7 x 8 inches.

Truck Wheels:
- Diameter—33 inches.
- Journals—5 x 8 inches.

Wheel Base:
- Driving—14 feet 9 inches.
- Total engine—22 feet 2 inches.
- Total engine and tender—43 feet.

Weight:
- On drivers—83,100 pounds.
- On truck—17,150 pounds.
- Total engine—100,250 pounds.
- Total engine and tender — 179,550 pounds.

BALDWIN MOGUL FOR MIDLAND RAILWAY OF ENGLAND.

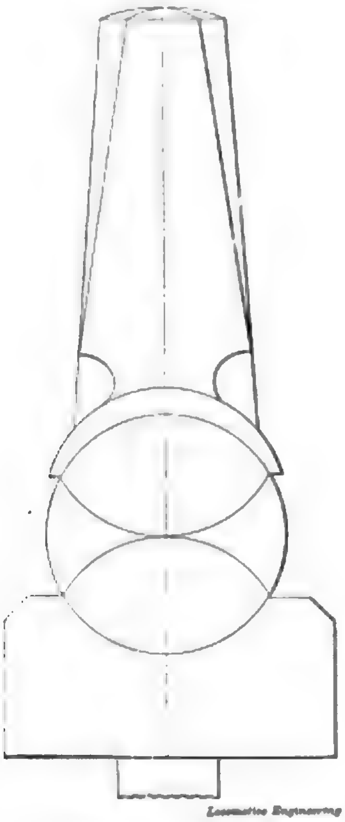
There was a tremendously fast run made on the Chicago, Burlington & Quincy on April 14. A distance of 197.3 miles was made in 192 minutes, including stops, and in 183½ minutes running time. The "Burlington route" is gradually gaining a reputation for the fast running of trains. The company's fine motive power and excellent road-bed make fast running possible and safe.

Blacksmith Tools for a Railroad Shop.

BY JAMES RAHILLY.

Any blacksmith shop handling locomotive or car work, either building new or repairing, can add to the rapidity of turning out work as well by having a complete set of smith's tools as by any automatic machine. The machines are good; both together are better.

There should be a tool room like a machine shop, where all templates, drawings, formers, punches, drifts and special tools are kept. There should be about



BLACKSMITH TOOLS—FIG. 1.

one steam hammer to every four fires, and cranes so arranged that each fire can swing its heat to the hammer.

Top and bottom swages from half to three and one half inches by eighths, and from this to six inches by quarters, should be made and made right. When these are made as they should be they will give good results and please the user. This is the way I make them. In making bottom swages get out a square block, punch a square hole in it of same size as anvil hole. Get a piece of square steel of this size for an axle and make it long enough to handle easily. Then start to block out your swage. But don't make a swage for more than one size; double swages are a delusion.

After heading down in your block, narrow it up and square the ends. Put it in the block again, level it up with the hammer and then take a piece of round steel smaller than you want to make it. Sink this down in a straight line through the center of your swage. After you have it where you want it, take a size from 1-16 to 1/8 inch larger than the size you want to swage in it and drive it down until its depth is as shown in Fig. 1.

Now take it to the anvil, put it in and see how it lines up for being square. Trim off one end square with anvil, let the other end project 1/8 inch over the anvil. The sides will be spread out; so trim them, square down and smooth up with flatter. Heat it and put it in anvil. Take the piece of round iron; wet it. Set your swage on and have the helper strike it hard, dipping every time to make the block well inside. Then put your top swage out near the end and strike a couple of blows, repeating at the other end. This leaves it high in the middle, and will not cut up work as a straight groove will.

Make top swage, and in fact all tools that are handled all day, as light as possible. The light tools last longer, too, as they do not crystallize so easily. These should be made of tool steel. Make top swages by heading down like a flatter and then bending into shape. Take a pair of dividers and set at half the diameter of swage. Set one point in the center of the arc and mark the circle. This will give your swage one-third of the circumference, as shown in Fig. 1. Forge the lips down smooth; also take care that your swage is square and true when finished, as this enables better work to be done.

The latest application of the Roentgen rays is to the testing of coal. It is stated that carbon in all its forms is quite transparent to these rays, while the substances —silica and the silicates—which constitute the ash or incombustible constituents are opaque to them. By placing a lump of coal between a Crookes tube and a fluorescent screen it is stated that all the slag and clinker-forming portions of the fuel can be detected. M. Cuoriot, on whose authority this statement is made, has tested in this manner anthracite and bituminous coal, lignite coke and artificially prepared briquettes. In these tests, rough lumps of coal 1⅛ to 2 inches thick may be used, with an exposure of five minutes, and with a coil giving a 10-inch spark.

Railway companies are not taking kindly to the car trust. Their hostility to the combination which proposes to increase artificially the cost of cars, is taking the form of arranging to break the combination by the simple alternative of railroad companies building their own cars. A great many railroad companies have car shops that can turn out cars as cheaply as contract shops, and build them better. Many localities hail with acclaim the car trusts that throw business into their own local shops.

The Musical Brakeman.

BY F. M. NELLIS.

Tom Stein, sitting on the roof of the second box car from the engine, his plump legs dangling over the side, struck me as being the greenest brakeman I had ever seen. He was playing a small 3-inch harmonica, totally oblivious to the locomotive whistle's call for brakes. So absorbed was he in his playing that a second blast of the whistle, accompanied by a lump of coal shied by the fireman, was necessary to call the player from pleasure to duty. He scrambled to his feet as quickly as his round body and the rolling motion of the train would permit, and swung vigorously on the brake wheel. Once aroused to duty, however, Tom showed a surprising agility in getting on and off moving trains and running over the tops of the cars; but the moment his work was finished, the little harmonica was fished from the tight vest pocket and was soon moving between Tom's lips.

One day Stein laid off the run, and we learned that he had been to Pittsburgh and carried off first prize in a harmonica contest held by an enterprising manager of one of the small theatres. We entreated Tom to play, but he refused, saying that he had "blowed the darn thing all out o' tune" in the contest. He promised, however, to play for us as soon as he could get a new harmonica; whereupon we put our heads together to devise some scheme to obtain the instrument.

Steubenville lay just across the river, only a mile away; but we couldn't get there, as the track across the bridge would be "kept hot" with scheduled trains for three hours yet. Wellsburg was eight miles down the river on the Wheeling branch, where no scheduled trains were due for forty minutes.

"That's just the place!" exclaimed Jim Curry, the conductor. "We'll go to Wellsburg!"

Ten minutes later, the engine with two box cars, and the caboose to steady her, was flying down the south shore of the Ohio River. An odd trip it was—a locomotive, two cars and caboose, with a full crew, making a sixteen-mile trip at express-train speed, burning the railway company's coal, to buy a fifty-cent harmonica for the head brakeman.

When we returned, Curry wired the superintendent, in explanation of our queer conduct, that the engine was out of water and quick action was necessary.

Then Tom Stein, the country-boy brakeman, bashfully took his position before us there in the little waiting room at Wheeling Junction. His clothes fitted so tightly as to suggest his having been melted and poured into them as a candle is molded. The uncovered part of the shirt between the trousers and vest told that Tom Stein was a growing boy. The round top of the old derby hat, pulled down to his ears, was no rounder than the ruddy, freckle-bespattered face underneath it.

After executing a few preliminary scales and flourishes, Tom dashed off into a popular march. The new harmonica was small and decidedly cheap looking, but its volume and range were surprising. As he played, the red-headed, freckle-faced boy before us faded from view, and in his place we could see our old favorite Seventh Regiment Band, of Pittsburgh, and hear its stirring music as it marched up Smithfield street between the tall buildings. The deep tones of the heavy brass instruments swelled and reverberated, filling the street. The shrill notes of the cornets, piccolos and clarionets echoed and re-echoed above the crowd standing in front of the Post Office and Hotel Duquesne, as the forty blue-and-gold-uniformed musicians marched up the slippery street.

For an instant the harmonica was removed from between Tom's lips and given a thump in the palm of the broad, freckled hand to adjust the reeds after the severe strain.

Then followed a waltz from "El Capitan." Again the tight-trousered performer, with a magician's touch, spirited us away to the Fifth Avenue Theatre, where we could see the full orchestra with the musicians below the foot-lights, and hear the swells and cadenzas of its well-known music. Curry brought us back to Wheeling Junction, however, by crossing to the door of the little telegraph office where Miss Jennie, the operator stood, nervously tapping the floor with her foot in time to the music. Curry had removed his hat, bowed deferentially to her, and spoke something in a low tone. She smiled and nodded her head assentingly, and soon the little operator and conductor were whirling around the room to the music of Tom Stein's harmonica. As the music ceased, Miss Jennie, with crimson face, declared "she couldn't help it," and retreated to her office and the company of her electrical instruments.

But Tom Stein had kept the best until the last, and at the finish of the waltz he glided off into "The Mocking Bird." The large, calloused hands half hid the ruddy, freckled face at times, and folded and unfolded about the harmonica with marvelous effect. As he played he twisted and humped, and the little three-inch instrument poured out the sweetest of bird song. There was the piping of the quail in the music, the warble of the linnet, the trill of the thrush, the twitter of the sparrow and the call of the bob-white. I could hear the gay whistle of the robin on the spring morning as I came down Hanlon's Hill on "No. 1," and could smell the sweet fragrance of the wild locust and dogwood blossoms, which hung on the heavy early morning air when the south wind blew across the valley below. I could hear the shrill call of the blue jay from its corner of the rail fence below Cadiz water tank, just after you pitch through the tunnel coming east on "No. 8," and face for the first time the full glare of the early morning sun. There was also the song of the high-soaring lark, as we stood taking water at the tank, watching the leakage flow down the ditch along the stone-ballasted track through the culvert into Carmody's meadow below. Then the air became suddenly filled with the joyous notes of a thousand bursting throats joining in one grand anthem of bird song.

Gradually the grand chorus drew away, becoming more and more distant, until it finally died away altogether, leaving only the sound of soft breezes in the tall tree tops.

I have since heard famous orchestras and performers in the grand theatres of cities; but none of them gave me as great pleasure as the red-headed, freckled-faced brakeman and his harmonica in the little waiting room at Wheeling Junction.

BOOK NOTICE.

"Echoes from the Rail; Or, Eighteen Years of Railroad Life." By Elmer R. Pilling, passenger conductor, P. C. C. & St. L. Ry., Dennison, O. Published by the author.

This is a little book which was written by the author while confined to his room by an attack of locomotor ataxia, and contains notes of his experience of eighteen years through various positions from track man to passenger conductor. It relates in rather homely form a great many incidents and experiences of railway life. The story will appeal strongly to those who have gone into train service as greenhorns and experienced all the buffetings and annoyances of that situation. The description of what was seen and experienced will appeal strongly to any railroad man who has gone over the same ground. The book is sold by the author for 25 cents, and is well worth the money. Those who feel like doing a good turn, and at the same time helping a deserving man, should send for the book.

Highest Artificial Heat.

Prof. Tucker, of Columbia University, has succeeded in producing the greatest heat yet known to man. A specially constructed electrical furnace and a current of unusual power were used to create this temperature, which was so high that under it steel, hard quartz and even platinum were vaporized. As for ordinary crucibles, they disappeared at once in a little puff of smoke. The heat obtained was 6,500 degrees Fahrenheit, 200 degrees hotter than any temperature before produced, says the Philadelphia *Record*.

It is difficult to appreciate the degree of such heat without some comparisons. Scalding water means a temperature of 212 degrees Fahrenheit, and red-hot iron 800 degrees. Steel melts at 3,000 degrees, and boils like water at 3,500 degrees. As for the heat of the sun, it is estimated at 10,000 degrees, so that Prof. Tucker ob-

tained a temperature which came within only 3,700 degrees of old Sol himself.

Of course a special apparatus was needed to measure the temperature obtained by Prof. Tucker, ordinary thermometers being quite out of the question.

The arrangement used for this purpose is called a calorimeter, and it is a rather intricate piece of apparatus. While it depends upon mercury for the recording of the degree of heat or cold obtained, the reading is not made in the direct way that obtains with the ordinary thermometer. The readings of the calorimeter are taken, and some calculation is necessary to determine the exact value in degrees of heat or cold of the figures. Because of this fact it is usually found that the actual heat obtained is slightly above that recorded. The heat obtained by Prof. Tucker was 6,500 degrees; it is not improbable that it was nearly 6,800.

The Gould Steel Platform.

The annexed engravings show the Gould steel platform for wide-vestibule, narrow-vestibule and non-vestibule passenger coaches, baggage and express cars.

The ordinary passenger-car platform for many years has been the "Miller" construction of wood framing, with modifications, from time to time, for additional strength.

Improvements in car construction, increasing their weight, and the addition of wide vestibules, require that additional strength be made to the platforms, insuring strength, rigidity and security from accidents.

To meet the above requirements, the Gould Coupler Company has placed on the market an improved form of steel platform, which meets all demands as to strength—lateral, vertical, tensile and compressive—with extreme simplicity in construction.

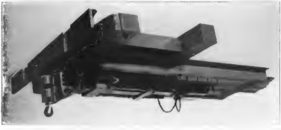
The main principle in the construction of this platform is in the use of Z-beams, giving lateral, as well as vertical, strength. Z-beams have the advantage over other forms of structural beams of lateral stiffness. As used in this platform, by turning the top flanges outward from the center of the car, they form a natural brace, laterally.

The large, flat, parallel flanges give excellent surfaces for all bolt-nuts and rivets, as well as large surfaces for all contact joints.

The three steel tie-plates are riveted to the underside of the flanges of the two central beams, and on top of the bottom flanges of the two intermediate or side beams. This ties the beams firmly at the bottom, and the large flat flanges, when bolted to the platform and car sills, make a firm tie at the top.

The form of the Z-beams admits of a strong, compact and simple arrangement of the draw-gear attachment, as clearly shown in the cuts.

The draw-gear is easily accessible, and removed, for renewal of draft spring. The construction is simple, strong and compact. The through bolts holding the draw-gear castings and steel beams through the car sills, are not removed when removing the followers and the draft spring. The bolts holding the draw-bar guides pass through the draw-bar castings and the lower flanges of the center steel beams. They are accessible and required to hold the wrought-iron draw-bar guides in position, while the pulling and buffing strains are taken by the lugs of the draw-bar castings, which are of malleable iron.



GOULD STEEL PLATFORM.

The draw-bar castings take the wear of the followers, and protect the lower flanges both on the bottom and edges of the central Z-beams from the action of the followers.

The coupler-carrier yoke is held laterally by abutting against the lower flanges of the steel intermediate beams, relieving the yoke bolts of all lateral strains, and preventing the wearing of bolts and holes in the supporting tie-plate.

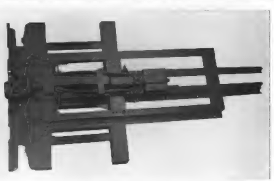
As shown by the cuts, the steel beams are strongly and firmly bolted to the end sill of the car, and also the car sills. The malleable iron buffing casting, bolted to the top of the center beams, and between the platform and sill and the car end sill, forms a solid abutment in direct line of the car framing, transmitting all buffing shock in a direct line of the greatest re-

sistance. This makes a solid construction, and relieves all the bolts, holding the steel beams to the car framing, from buffing shocks preventing the wearing of the bolt holes in the car sills, and insuring the platform of always being held firmly in its proper position.

In case of collision, the construction of this platform prevents any possibility of the cars telescoping or being badly damaged.

The construction is simple, and permits of being easily inspected and repainted. All parts pertaining to the coupler and brake rigging can easily be attached, inspected and repaired.

This steel platform is adapted to the Gould continuous buffer and coupler, without changes, and where these devices are now used, with wooden platforms, these parts remain standard, and are interchangeable with parts used with steel platform. This platform is no heavier than equivalent parts of the Gould standard wood platform. A careful consideration of this platform will be convincing of its simplicity and advantages.



GOULD STEEL PLATFORM.

Some experiments have been made at Cornell University by Professor R. C. Carpenter on the effect of temperature on the strength of materials. In the case of iron and steel the experiments showed the strength to be practically a minimum at 70 degrees Fahr., while at 500 degrees Fahr. the metals are about 20 per cent. stronger than at 70 degrees. A similar increase of strength occurs on lowering the temperature to —60 degrees Fahr. That is probably true for a steady pull, but we have not altogether lost faith in the popular belief that metal becomes brittle at a low temperature. A sharp blow will cause fracture. The experience with metals at the temperature at which air can be liquefied seems to substantiate this view.

We have received a very interesting catalogue from the Shelby Steel Tube Company, of Cleveland, Ohio, concerning their boiler tubes. It contains a large amount of valuable data on the manufacture of these tubes and the uses to which they have been put. The manner in which they are drawn from the solid billet is shown, and there are two pictures showing the remarkable ductility of these tubes. The question of corrosion and pitting is also met, and a table giving weights and price of tubes of various sizes will be found of use. Those desiring a copy should mention catalogue C.

The Chicago Pneumatic Tool Company advise us they have in one day received orders for 158 pneumatic tools, including compressors, drills, hammers, riveters, etc. The orders for these tools were from many different concerns, including railroads, shipbuilding plants and manufacturing institutions. Their business for March, 1899, was the largest in the history of the company, being considerably more than double that of March, 1898, and the increase for April is still more marked. The tools are going to parties who are increasing the use of pneumatic appliances in their work, and this increase in trade is a fair index of the general business of the country.

The Panhandle & Fort Wayne firemen say that you cannot see a promotion in sight with a Lick telescope on these roads. Some of the men have been shoveling coal for seventeen years and have never been advanced. A number of firemen on the Pittsburgh & Lake Erie Railroad were lately notified to prepare for examination as engineers. It is said that although they have been waiting for promotion so long, few of them were prepared to pass the examination, and that there was a great rush for air-brake books and others, telling what to do in case of accident or emergency.

The Light Method of Firing is Old.

We have received from Mr. W. H. V. Rosing, mechanical engineer of the Illinois Central Railroad, at Chicago, a copy of a notice which used to be put up in the cabs of passenger engines on the Illinois Central. The poster reads:

"Machinery Department, Illinois Central Railroad.
Weldon, May 7th, 1868.

SPECIAL INSTRUCTIONS TO PASSENGER ENGINEERS.

To prevent your engine throwing out large quantities of smoke, you will see that your fireman is very particular in the manner of firing, and that he observes closely the following rules:

Do not throw more than two shovels of coal at one time, and scatter it well over the grates.

Keep the fire as nearly uniform as possible.

Keep the coal in your tender dampened, so that the dust from it will not be blown back upon the train. Whenever the steam is shut off, the blower should be used lightly.

The air openings around the furnace and in the door should be kept open as much as possible.

Much of the annoyance from smoke and coal dust will be prevented and a large saving in fuel effected by attention to the above rules.

S. J. HAYES,
Superintendent of Machinery."

The Chicago Pneumatic Tool Company are pleased to announce some valuable acquisitions to their working force in securing the services of Messrs. W. P. Pressinger and J. M. Towle. Mr. Pressinger is well known to users of compressed air everywhere, through his long connection with the Clayton Compressor Works, and he now leaves them to work with the New York office of the Chicago Pneumatic Tool Company. Mr. Towle, who will open an office in Boston, has been for the past ten or twelve years engaged in the manufacture and sale of pneumatic tools, and is an expert in that line, and well known throughout the East, where his work has principally been done. This arrangement gives them offices in Chicago, New York, Boston, Buffalo, Pittsburgh, St. Louis and San Francisco, thus enabling them to reach their trade all over the United States.

A circular letter has been sent out by the Gisholt Machine Company, Madison, Wis., in which strong grounds are taken against the high tariff duty imposed in the country on imported machinery. The letter says: "As practically no machinery is imported, or will be imported if admitted free, why have any duties at all on machinery? It produces no revenue to speak of, and will produce none. The duty is now 35 per cent. Why not abolish it entirely, or reduce it to 5, or at most 10 per cent.? One of the proprietors of this company has been traveling in Europe in the interest of our business for the last two years, and as he speaks some of the continental languages, gets pretty well acquainted with European sentiment. The manufacturers there would be satisfied if we would impose duties equal to those they impose. The writer of this letter has been and is a protectionist, when protection is necessary to promote our interests. But protection, certainly in the machine line, has done its work. We feel that we neither need nor want the protective tariff any longer, and we know there are leading members of Congress who have been protectionists, who feel the same way, and are ready to vote as they feel, if that is what our people demand."

We recently heard Mr. Tripler explain how he could get 10 gallons of liquid air by the use of 3 gallons in his machine. We confess to being disappointed, as we had the idea he never claimed it, but laid it to an enthusiastic writer. The explanation not only failed to explain, but left the impression that he was endeavoring to use the alleged mystery of extremely low temperatures to make people think two and two make six.

The Marshall & Huschart Machinery Company, Cleveland, Ohio, selling agents for Gould & Eberhardt, of Newark, N. J., have sold to the Brown Hoisting & Conveying Machine Company, Cleveland, an automatic gear-cutting machine of 120 x 20 inches capacity. This machine is a duplicate of one built by Gould & Eberhardt and recently installed at the works of the Blake steam pump plant at East Cambridge, Mass. It is said to be the largest size of entirely automatic gear-cutting machines built.

M. C. Hammett reports the sale of a 10 by 10-inch duplex air compressor to the Oahu Railway & Land Company, Honolulu, Hawaii. He is also pleased at the reception accorded the Sansom bell-ringer, which was illustrated in our last issue.

One of the cylinders of the Stourbridge Lion, the first locomotive ever run in America, is in the possession of George B. Smith, of Scranton, Pa., as well as the connecting rods of both cylinders and pumps. The other cylinder is in the keeping of the heirs of Steuben Jenkins, of Wyoming, Luzerne County. The driving wheels and boiler are on exhibition in the Smithsonian Institution, Washington. It is a pity that all the remaining parts of this old and interesting engine cannot be put together in the Smithsonian Institution.

High Speed—Slow Exhaust.

"When they first began to use the air brake common like," said an old-time Pennsylvania man, "one of the boys stopped at Newark after a pretty lively spurt over the meadows with his air pump working to get up pressure in the reservoir. A stranger heard the exhaust, and stood open-mouth to hear an exhaust with the engine standing still. So he asked about it, and the fireman said, 'Well, you see, Bill, he run so humpin fast 'cross the meadows that all the exhausts didn't have time to go out. Them's the rest of 'em working out now.'"

The engineering department of the Burlington Railway has completed plans for the season s work along the road. Some heavy grades in Illinois will be reduced and several curves eliminated. Thirty-five miles of double track will be laid in Iowa, and a new line will be built from Grant City to Albany, Mo. A new bridge will also be built across the Des Moines River.

The Baltimore & Ohio Railroad have issued a notice that beginning with the payment of wages by check on the first of May no orders will be accepted upon any employé's salary. Notices to this effect have been sent broadcast along the road in order to fully inform merchants and others of the new order of things.

The Lake Shore & Michigan Southern road are sending out a colored picture of their "Exposition Flyer," speeding along the lake front. In the corner is a flyer from the old Erie & Kalamazoo Railroad, with its sugar-loaf boiler and two-story car, that looks like a young meeting house.

There is talk of the Carnegie interests, which control the Pittsburgh, Bessemer & Lake Erie, building car and locomotive works of sufficient capacity to provide for the wants of the road. We know Mr. Carnegie pretty well, and our acquaintance with the mainspring of this reputed movement leads us to believe that it will never go.

Mr. George William Hoffman, Indianapolis, writes us: "I am pleased to inform you that I have made the third shipment of metal polish to foreign countries this year. They each consisted of a carload. Business is good and expect a prosperous year."

A somewhat elaborately illustrated index of their hydraulic tools and miscellaneous machinery has recently been published by the Watson-Stillman Company, of New York. The pamphlet contains forty-four pages filled with cuts of every description, and will be found a useful handbook of reference.

A Firing Experiment.

"Speakin' about firing with one shovelful at a time," said an old timer the other day, "I remember a trick Al. Griggs tried on the old Boston & Providence of not firing at all between Boston & Providence, in about 1860. I was on the old 'Neponset,' which had a firebox 34 inches wide and 48 inches long. He filled her up pretty full before starting and let it coke a little, then after they pulled out he punched two holes down through it to let the air get through.

"Never touched her again till he struck Providence, forty-three miles, I think it is, and she steamed like a top. 'Twas a fast train for them times, too, and I've often wondered how he dared try that game—but he got through all right. Ef he hadn't he might a got fired himself."

"Saratoga the Beautiful" is the name of the latest folder sent out by Mr. Geo. H. Daniels, general passenger agent of the New York Central. It is beautifully illustrated with a great many views in and around Saratoga, and will be found a useful reference to those who are looking for some place where they can have a pleasant time during their summer vacation.

The Utica Steam Gage Company have moved their office out to their works in Frankfort, ten miles east of Utica, where all communications should be sent. This gives them the advantage of having the office and shops more closely in touch, which is very desirable in nearly all cases.

The passenger department of the Burlington route has sent out an illustrated pamphlet showing very handsome half-tone views of the new station at Omaha. Those who are interested in station buildings and like to look at pretty half-tone cuts should send for this pamphlet.

One of the most welcome exchanges that comes to this office is the *Locomotive Magazine*, published by Mr. F. Moore, 9 South Place, Finsbury, London, England. It is always brimful of fine engravings and interesting reading matter. The subscription price is six shillings a year.

W. C. Baker, of New York, has received an order from W. S. Laycock, a Government and railway store contractor, of Sheffield, England, for six "Mighty Midget Heaters," to be used in equipping a train for an English railroad.

The Chicago, St. Paul, Minneapolis & Omaha Railroad Company have ordered the Wallace & Kellogg air-pump exhaust attachment placed on the ten engines that are being built by the Schenectady Locomotive Works.

Quick Bridge Building.

English bridge builders are so chagrined over the quick work of the Pencoyd Iron Works in shipping a bridge for the Soudan in seven weeks, that they intimate the plans were given to them first, as "no firm could build a bridge like that in seven abroad.

The Pencoyd concern deny any advantage and claim they could build the bridge in seven days, if absolutely necessary. If there is this difference between the builders on the two sides of the Atlantic, we may look for more bridge work from abroad.

The Standard Pneumatic Tool Company, Chicago, have established offices at 619 Washington Life Building, 141 Broadway, New York City, where a full line of their pneumatic tools and appliances will be on exhibition hereafter. The results obtained in the Eastern States and foreign countries during the past year has been very gratifying, and they feel confident that their business will be greatly increased by the addition of offices mentioned, as they will be in a position to give their European customers better service relative to shipment of material. Mr. John D. Hurley will have charge of same.

A dozen or more of the forty-five consolidation compound freight locomotives recently ordered for use on the southwestern division of the Baltimore & Ohio Railroad are in service and giving splendid satisfaction. On the Mississippi division they have increased the train haul 40 per cent. over the old line. When the grade reductions are completed the improvement will be even more noticeable. The compound ten-wheel passenger engines have developed unexpected pulling power and unusual speed.

"Who Uses Mechanical Draft?" is the name of a pamphlet recently issued by the B. G. Sturtevant Company, of Boston, which gives a long list of the people who use mechanical draft. The same concern has also issued an illustrated pamphlet showing places where draft is created without a chimney. Both of these publications will be found useful for those interested in mechanical draft.

Henry F. Shoemaker, vice-president and chairman of the executive committee of the Cincinnati, Hamilton & Dayton Railroad, denied the report that the Vanderbilt system of railroads had absorbed the Cincinnati, Hamilton & Dayton and Monon routes, and would operate them in connection with the "Big Four" system. "As far as the Cincinnati, Hamilton & Dayton road is concerned," said Mr. Shoemaker, "there is no truth in the report. The majority of the stock of the road is held by myself and my friends, and we have not sold a dollar's worth of it. In fact, there have been no negotiations tending toward the purchase of our stock on the part of any corporation. The Cincinnati, Hamilton & Dayton Railroad remains an independent corporation, and is not part of any system."

Manning, Maxwell & Moore, of 85 Liberty street, New York, have just published a very handsomely illustrated catalogue, showing a great variety of the Shaw electric crane, for which this company are sole agents. The illustrations are mostly in excellent half-tone engravings, and they illustrate a great many purposes for which this kind of traveling crane has been applied. The catalogue also contains under the head of "General Remarks" a great deal of valuable and useful information about traveling cranes, which have now come to be considered an essential tool for all first-class machine shops, foundries and manufacturing establishments where heavy material has to be handled. People who have any thought of investing in a traveling crane would do well to send for this catalogue. Those who are in charge of this kind of crane would also find the description very useful as a means of instruction about such appliances.

The following paragraph, headed "Incivility," is from the time-table of the Boston & Albany Railroad, and the last sentence is especially to be commended to a portion of the traveling public: "Passengers are respectfully requested to report to the general passenger agent any instance of incivility on the part of the employés of this company. While it is the aim of the company to redress just grievances, it is suggested that courtesy is equally commendable, whether practised by the railroad employé or the passenger."

The Champion Oil Company, Old Colony Building, Chicago, Ill., have issued a booklet concerning what they call their fireproof oil. From letters published, we should conclude that the oil was not only a very good preventative of hot bearings, but is also good for cooling off hot boxes that have a temperature above the igniting point of ordinary lubricating material.

McConway, Torley & Co., Pittsburgh, Pa., have published a Catechism of the Master Car Builders' Rules of Interchange, which is intended for the use of inspectors at interchange points and others whose duty it is to be on familiar terms with these rules. The catechism is got out in a very simple manner, and will be found a great aid to car inspectors. It is in neat form for the pocket, and has a number of blank pages suitable for putting notes upon. Anyone interested who has not received a copy of this pamphlet will obtain one on application to the company publishing it.

A novel sort of train signal has been invented by Mr. J. B. Marston, division superintendent of the Delaware, Lackawanna & Western at Buffalo. As far as we can understand the description, the signal consists of two marker lamps or flags set on the top of the caboose. These are connected with an eccentric on the axle, which gives them an up and down motion. The rapidity of this motion constitutes the signal, since the engineer of a train following can tell from the rapidity of the jerks how fast the train is running. This knowledge, it is argued, will be the means of preventing collisions.

The following letter, dated April 6th, speaks for itself: Reed City, Mich., April 6, 1899. Buffalo Forge Company, Buffalo, N. Y.: Gentlemen—Acknowledging your favor of the 31st ult., would say that we have equipped our foundry and blacksmith shop, and were very fortunate in getting blowers for our cupola and blacksmith forge. We would not think of using anything but the "Buffalo." It is the only blower we know of that will stand up and do its business. We have tried four other kinds, but have not been able to find any that will compare with your blower in any way whatever. Yours very truly, The National Iron Company.

That the wonderful tidal wave of prosperity which is now sweeping the country is not confined to any particular trade or business, is evidenced by the very large number of orders received by the National Pneumatic Tool Company, of Philadelphia, during the past month. This company succeeded to the business of the C. H. Haeseler Company, March 1st, and its business during that month was four times as large as that of the predecessor company in its best month. Their orders included thirty-six of their drilling and reaming machines for the Schoen Pressed Steel Company (the largest single order from a consumer ever given for this class of tool), ten to the Atlantic Works, East Boston; eleven drills to the Baldwin Locomotive Works, four to the Dickson Manufacturing Company, beside a multitude of drills and hammers in smaller lots to other concerns all over the country. These orders were all secured after competitive test and speak well for the merit of this company's product.

Mr. A. A. Lindley, Oskaloosa, Ia., an engineer on the Chicago, Burlington & Quincy, has invented and patented a new sand blast for locomotives, which he declares is unequalled for simplicity, durability and effectiveness. It is said that this sander will feed a fine, continuous stream of sand upon the rails in a perfectly reliable manner when necessary, to prevent wheels from slipping. It has what seems to us a very simple means of clearing out the valve when anything gets in to obstruct the flow of sand. Anyone interested in this subject might send to Mr. Lindley for a copy of his illustrated pamphlet showing the working of the sand device.

The Falls Hollow Staybolt Company, Cuyahoga Falls, O., filled large orders last month for their safety hollow staybolts from the Neafie & Levy Ship & Engine Building Company, of Philadelphia, Pa., and W. & A. Fletcher Company, of Hoboken, N. J. The high grade of material from which these staybolts are made and the manner of making them render them superior in testing qualities, and their easy application makes them the most economical bolt on the market.

The authorities of Purdue University have sent out a pamphlet on their railway engineering and management course. It contains a great deal of useful information that will be found interesting for those who are desirous of obtaining a scientific education to fit them for railroad work. The Purdue people have also sent out an illustrated pamphlet giving selected views of Purdue University. They will also be found very interesting reading.

The railroad expert believes that the number of revenue tons hauled per mile is the best indication of a railroad's ability to handle traffic at the lowest cost of transportation. As is well known, the receivers of the Baltimore & Ohio Railroad have been spending millions on improvements and have not completed the work, the lines west of the Ohio River being in need of a general rehabilitation, which they are to get this year. But the revenue haul per mile in 1897-98 was increased to 314 tons, and a special report for the six months ending December 31, 1898, shows an average of 331.9 tons, quite an appreciable advance.

"Rock Drills" is the name of an illustrated booklet recently sent out by the Ingersoll-Sergeant Drill Company, of New York. It contains a variety of half-tone pictures of the drill at work, and will be found a useful reference for those who have to use that tool.

A genius who evidently has money to burn in the patent office has a valve gear which is novel in some ways. The link is hung by a lug at the back to the top of the frame. The link is moved by an arm at the top connecting through a rocker with an eccentric rod driven from the *front truck axle*. Of course this necessitates an eccentric rod about 8 or 10 feet long, but that doesn't matter. The link block is moved by a well sweep arrangement controlled by the engineer. It is certainly novel, also simple, but not so much so as those who put money into a device of this kind. But no line of inventing is so aluring as making a new valve motion.

CONTENTS.

INDEX TO ADVERTISEMENTS.

A Case Where Books Paid.

"Word was sent that ten firemen would be examined for promotion, and ten candidates for the right side presented themselves, with fear and trembling. After an easy examination, nine men failed, the other one passed both the engine and air brake ordeal. He was the youngest of the lot, too, and the examiner asked him how he happened to know more than the rest. 'Don't know, sir, unless it is because I read more. I have a copy of Sinclair's **Locomotive Engine Running and Management** and a few other good ones, and I take Locomotive Engineering.'"

This isn't a ghost story—it's a fact. The new edition, which is really a new book, is now ready at the same price as before—$2.00. Locomotive Engineering is always ready; new edition every month, also $2.00 per year. It will pay you to have both.

Angus Sinclair Company,

95 Liberty Street,

NEW YORK.

A LIST OF BOOKS

WHICH WILL HELP
ANY RAILROAD MAN.

Air Brake Catechism--Conger.

New edition. Is the most complete little Air Brake book in print. Contains standard air brake and signal instructions and will be found invaluable to any engineman. **25 cts.**

Catechism of Locomotive--Forney.

One of the standard books for those who want to know the how and why of the locomotive. Over 50,000 have been sold. **$3.50.**

Locomotive Engine Running and Management--Sinclair.

The new edition makes it the latest and best book for engineer or fireman. The other column gives a practical result of its value. Has traveling engineers' questions and answers. You want one. **$2.00.**

Locomotive Link Motion--Halsey.

This is the latest and best book on the link. Tells how it works, what effect different changes have on it, and all without a single calculation—just plain English. **$1.00.**

LOCOMOTIVE ENGINEERING,

95 Liberty Street, New York.

Bound Volumes of 1898

are still here—not very many though. If you want a record of last year's accomplishments in the railroad world, you have it here. $3.00 gets a copy, delivered free . . .

LOCOMOTIVE ENGINEERING, 95 Liberty St., New York.

A BOILER TUBE POINT.

The Allison Boiler Tubes are made of iron—unquestionably the most satisfactory material known.

If steel were better, could we afford to use iron exclusively?

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ALLISON MANUFACTURING CO.,

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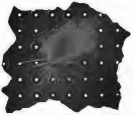
Staybolts...

BOTH HOLLOW AND SOLID, OF THE BEST QUALITY OF CHARCOAL IRON.

Hollow Staybolts

Are better than drilled or punched bolts in every way—cost less too. They save inspection and explosions—warn automatically.



If you want solid Staybolts, however, let us hear from you. Our circulars and prices will interest you.

Falls Hollow Staybolt Co.

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Locomotive Works and Car Builders NEED

The Armstrong

Pipe Threading and Cutting-Off Machines,

Adjustable Stocks and Dies, and other tools.

NEW NO. 0 MACHINE.

A Catalogue if you ask for it.

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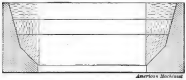
139 Centre St., New York. BRIDGEPORT, CONN.

Multi-Angular Packing.

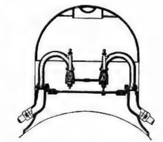


This is a new form of our regular packing for rods of any kind. The rings and vibrating cup shown, fit into the other regular parts of our packing, and wear better and longer than the old style. The new form enables a cheaper mixture to be used, and gives much longer wear than before, so that the packing is much less expensive and more satisfactory in every way.

Our packings are used in two-thirds of the locomotives in the United States.

Dean's Pneumatic Sander.

We think this has more good points than any other we know of. It uses any kind of sand that is usable and don't make any fuss about it. Doesn't clog or refuse to work when you want it to. It will save sand, tires, rails and time at stations, to say nothing of temper. Better look this up.



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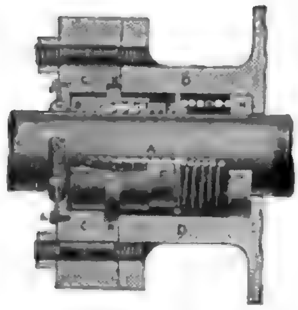
Specify FRAME DRILLS—RADIAL DRILLS—MULTIPLE DRILLS—FACING LATHES—ROCKERSHAFT LATHES—MADE BY



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AND ENGINEERS ALL CONSIDER

The Jerome Metallic Packing

THE BEST ON THE MARKET.

It is now in General Service on more Locomotives than any other Packing in the World.

The Packing Ring can be closed around the Rod without disconnecting the Piston Rod from Crosshead.

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FOR HAND AND POWER.

All sizes, ¼ inch to 18 inches for Pipe Mill, Gas and Steam Fitters' use. Tapping Machines for Steam Fittings.

ALSO

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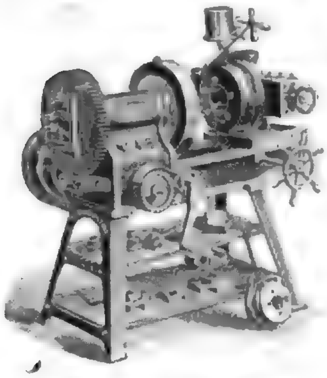

No. 4 B Machine, ½ to 4 inches Hand or Power.

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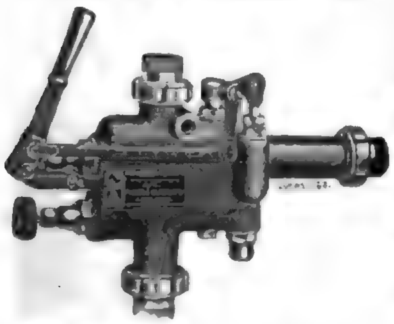
THE HANCOCK INSPIRATOR.

Absolutely no Adjustment..



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Our '99 R. R. Catalogue (just issued) *mailed free* upon application.

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Please mention "Locomotive Engineering."

Locomotive BOILER, Smoke Stack, Tank and Sheet STEELS.

Quality Unsurpassed.

Plates up to 118 inches in width.

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PURITY, DUCTILITY AND SOFTNESS.

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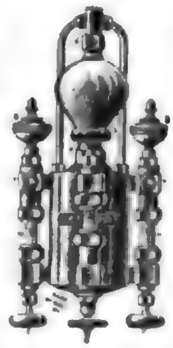

are up to date. They are always reliable with any pressure, as this device absolutely overcomes back pressure.

Shall we send you blue print and descriptive matter? . . . .

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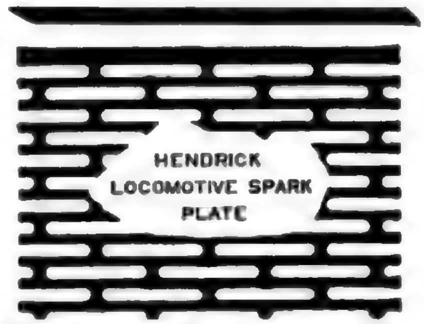

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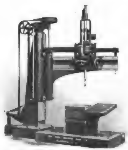

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"My practice with POND Radial is to put on all the feed, lock up friction clutch and LET HER GO; it is the work we want and our shop records show that we get it from our machines. As a sample of work, our average operators will do, from day to day, 26 7-8 INCH HOLES; drill, tap and stud same in 60 MINUTES.

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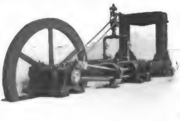

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Are in world wide use. Long experience with these tools enables us to make the tools best suited for railway work. They are simple, practical, economical. Catalog describes them.

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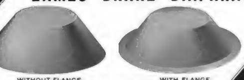

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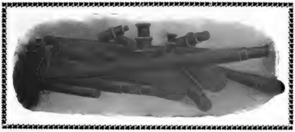

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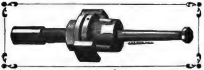

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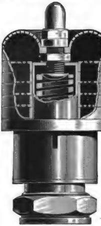

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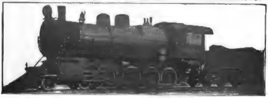

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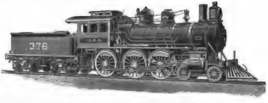

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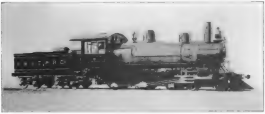

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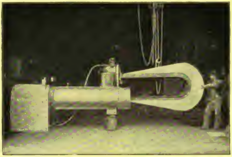

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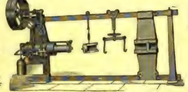

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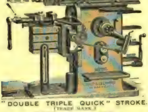

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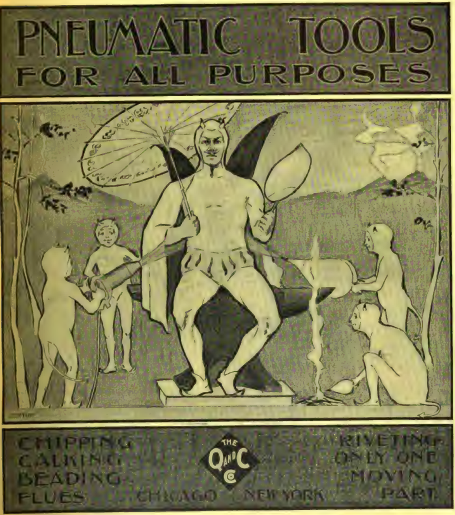

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LocomotiveEngineering

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XII 95 Liberty Street, New York, June, 1899 No. 6

Symons Express Engine.

On this and other pages we present views of a locomotive recently built by the Richmond Locomotive Works for the Plant system. The engine was built from specifications and designs furnished by Mr. W. E. Symons, superintendent of motive power of the Plant System, and it contains a variety of features that are somewhat unique and calculated to produce a particularly effective and durable engine.

The cylinders are 19 x 26 inches and the driving wheels 69 inches diameter. The working pressure is 200 pounds to the square inch, which gives the engine a little over 23,000 pounds tractive power and ratio of adhesion of 4.5. Richardson balanced valves and United States metallic rod packing have been used on the engine. More particulars of the engine will be found on the chart on page 250.

The indicator diagrams to be found on pages 259 and 260 will show that the steam distribution is unusually uniform for both ends of the cylinder. Variable exhaust nozzle was used, and it will be noticed that cards numbered 4 and 9, where the variable exhaust nozzle is closed, do not compare well with the mean effective pressure and indicated horse-power of other cards where the nozzle is open. The valves of the engine are set in such a way which makes the lead when cutting off short only about 7-32 inch. It will be noticed from the indicator diagrams that the cut-off is a little later on the back end of the cylinder than on the front, which was arranged with a view for allowing for the area of the piston rod, and thus making the terminal pressure about equal. The transmission bar employed for increasing the link radius which is illustrated with others on page 246, is one of the best arrangements we have seen. The cylinder fastenings shown on page 244 are also very well worthy of attention, as a double row of bolts goes all the way around. Another point worthy of attention is the spring rigging which is arranged so that it does not interfere with the driving boxes, pedestal, braces, wedge and bolts. There is also an arrangement on each driving cellar, whereby the cellar can be packed without even removing the cellar bolts. This is an opening covered by a little cap on the end of the cellar. Steel is used throughout in wheel centers, main and side rods, guides, crossheads being of one piece of metal with tin applied to the wearing surface about ⅛ inch thick. The front-end door and ring are pressed steel; the engine truck, center casting and all other parts where steel could be used are made of that material with a view of having the engines as light as possible.

Latrobe tires are used and the piston rods are of Coffin process steel. French springs are employed and secured to a sys-

SYMONS TEN-WHEEL EXPRESS ENGINE.

tem of equalizing beams of wrought iron, as may be seen in the engraving. Feed water is supplied by No. 10 Monitor injectors and the valve cylinders and air pump are lubricated by a No. 9 oval patent Nathan triple sight-feed lubricator.

The Westinghouse latest improved automatic combined outside brakes on drivers, tender and for train. Also the Westinghouse train-signalling device is on the engine, with a 9½-inch air pump and improved engineer's valve. The bearings are of Ajax metal, furnished by the Ajax Metal Company, of Philadelphia. Two 3½-inch Coale mufflers prevent over pressure of steam. Sand-box is fitted with the Leach sanding device. The engine is fitted with Golmar bell-ringer, chime whistle and a variety of other devices that promote convenience and comfort in handling the engine.

This engine made the run from Savannah to Jacksonville with the company's vestibule train in 3 hours 22 minutes, a distance of 172 miles, making four full stops and slowing down for two regular draw-bridges. There was a Boyer speed- ...der on the engine, and it showed ...peed of 80 miles an hour was fre- ...tained.

Testing for Color Blindness.

BY C. B. CONGER.

A very handy contrivance for assisting in this work, which can be used in a small room, and shows with the same effects that a switch light or other colored signal does at various distances, whether so far off that the light is just discernible, or so close that it seems to be only an engine length away, has been arranged by Dr. D. Emmett Welsh, the eminent oculist, who examines the employés of the Grand Rapids & Indiana Railway, the Chicago & West Michigan Railway, and the Detroit, Grand Rapids & Western Railway, at Grand Rapids, Mich.

An ordinary square lamp is used, of

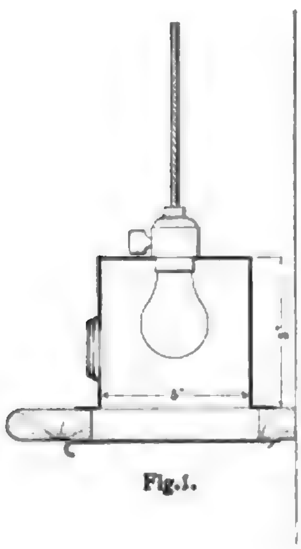


Fig.1.

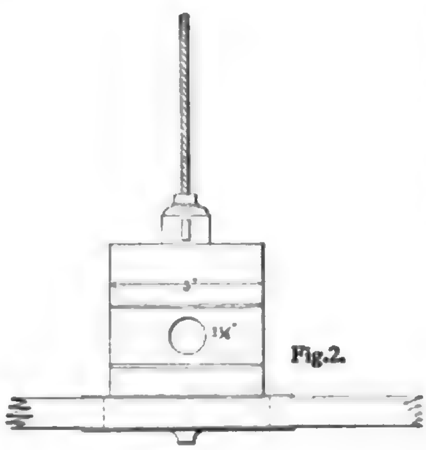


Fig.2.

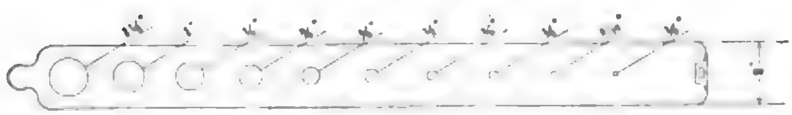
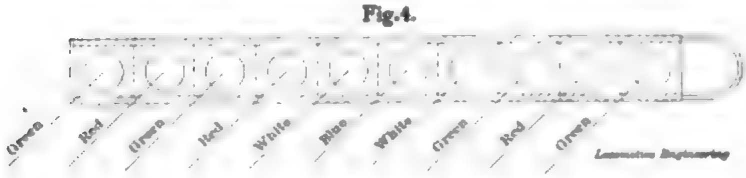


Fig.3.

Fig.4.



TEST FOR COLOR BLINDNESS.

which a side view is shown in Fig. 1. It is equipped with an incandescent electric light, which is used because of its great convenience when it is necessary to turn out the light during an examination. An oil lamp can be used for the purpose by having a slide to push in front of the opening, and thus cover up the light so it cannot be seen at all when necessary.

In either case the electric lamp or blaze from the oil lamp should come exactly in line with the opening in the front of the case, so a clear light will be thrown on the colored glasses shown in Fig. 4. The clips or loops which hold the two slides, Fig 3 and Fig. 4, are on the front part of the case, and one outside of the other, so both slides can be used at once and moved independently of each other. These slides are of sheet brass, 2 inches wide and as long as may be desired, taking care that the hole in the front of lamp is not over 1¼ inches in diameter, or that the openings for colored glass are not close enough so that two of them will show at the same time. One of these slides has a row of ten holes in it, ranging in size from ⅛ inch up to 1¼ inches. The other one has a set of colored glasses fastened to it. The illustrations make the matter plain.

In addition to this lamp a moderate sized mirror is used, which should be set about the height of a man's eye, and may be anywhere from 8 to 16 feet from the lamp. A good distance can be found the first time the device is used. It should be so placed that the light from the lamp shining through the holes in the slide and the colored glass will strike the mirror and be reflected back to where the man is standing whose vision is being tested. A very good arrangement is to set the lamp on a high stand or table in the center of the room, so that the man to be tested and the witnesses (for there should always be witnesses whenever there is any dispute as to the result of an examination) can all see the light on the mirror at the same time.

When the light shows through the ⅛-inch hole it will appear to be a long ways off, as it is a very small spot. The slide can be moved to successively increase the size of the opening with the apparent effect of bringing the light closer, until it is as brilliant as any light only a few feet off.

The effect of distance on various colored lights can be very plainly shown; for instance, the blue light is hardly visible through the ⅛-inch hole and is quite plain through the large opening of 1¼ inches. Other colors can be tried the same way. It is surprising how much difference there is in the various colors when the distance at which they will show plainly is taken into consideration.

With this device examinations can take place at any time day or night. As they are in a room which can be darkened, it is not necessary to wait until night, nor go to any distance to find a suitable yard where the lamps can be shifted at will.

This examination for color blindness should be made with a good deal of care, for it is just as serious a matter to let a man pass who is defective in his sense of colors, and run the risk of an accident on the road which will cost some other employé his life or limbs, as it is to take a man's situation away from him by proving that he is unable to distinguish the standard colors used in railroad signals.

There was a time years ago when this test was regarded as a scientific fad, and

there was a strong opposition to it on the part of all operatives; but it has long ago been proved to be a sure enough fact. If the test is honestly made there should be no prejudice against it. If a case of color blindness is discovered, the man's fellow employés should be called in to witness a test, and thus be able to assure themselves that it is an actual fact.

Most of the prejudice has come from the use of colored yarns instead of colored lights. In some cases the names of the various shades of each color were required. Anyone whose sense of color is perfect can match the various standard colors used on railroads, when shown samples of them, but very few engine men and train men are educated to name all of them. The test of matching various colors of yarn is used because it can be made quickly and with so many variations of color that defective vision is soon detected; but the final test in case of any doubt should always be made with colored lights of the same shades that are used on the road. The writer has seen the above device used hundreds of times and decisions always approved by the witnesses.

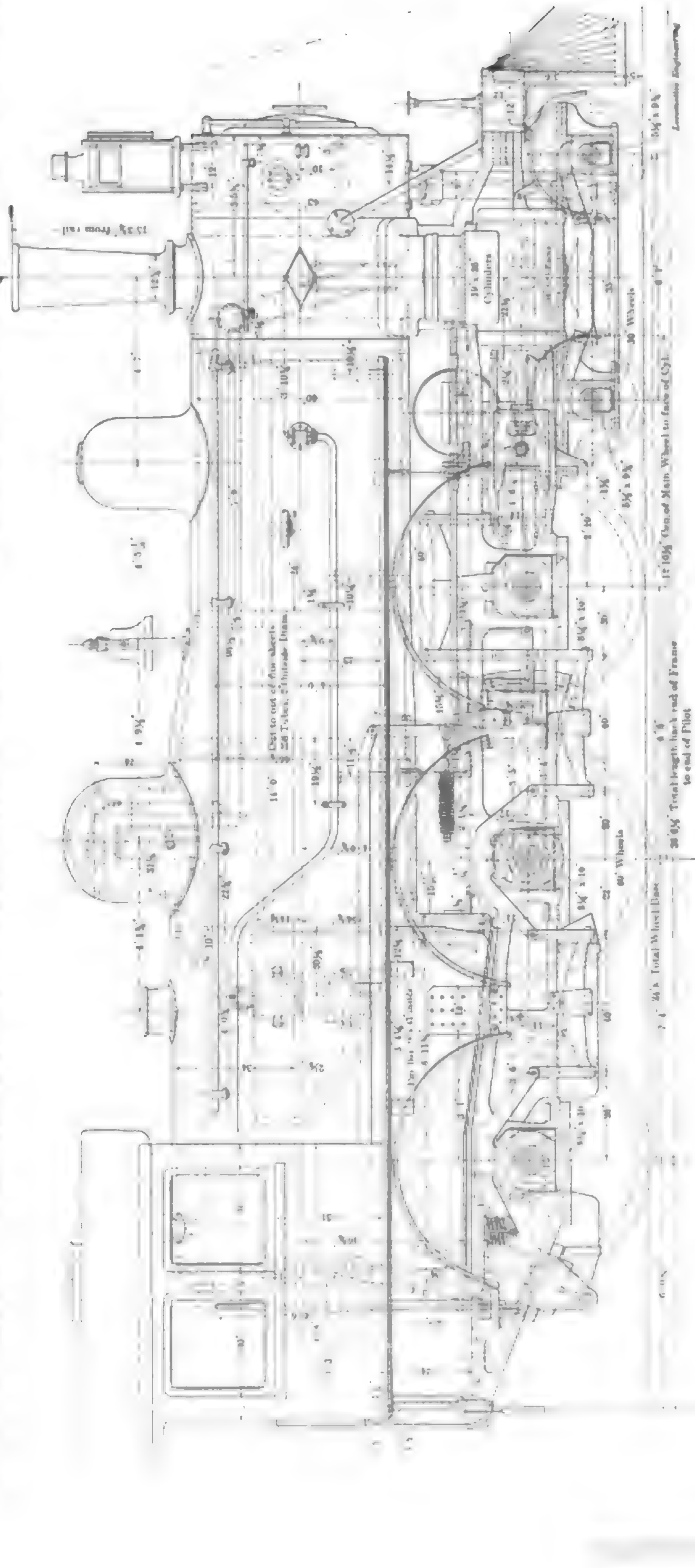
The Allen Valve.

Mr. C. H. Quereau, who has long been an advocate of the Allen valve, presented a very able argument for its use on high-speed locomotives.

He demonstrated by indicator cards taken at 55 miles per hour that valves can be set to avoid excessive compression, which is sometimes charged to this type of valve. This, he says, is caused by too much lead, and the cards prove his case. The objection as to valves being heavy, he meets by giving the weight of an Allen valve for a 19 by 24-inch engine, having ports 1½ by 17¼ inches, as only 112 pounds without packing strips.

He quotes extensively from those who use the valve and who advocate it for any but low speeds. Among those quoted are E. M. Herr, Joseph Cockfield and Von Borries. It is claimed that as more steam is admitted than with the plain valve the engine is more powerful, and one case is cited where a 16 by 24-inch engine with Allen valve did as satisfactory work on freight as a 17 by 24, as long as the speed was fair. At very low speed the latter could outpull the former.

The wavy compression line which always accompanies the Allen valve, Mr. Quayle attributes to the high-pressure steam which is confined in the Allen port being admitted to the compression side of the piston as the valve moves over to admit steam at that end of the stroke. This increase of pressure causes a few impulses on the indicator piston and produces the wavy compression by which an Allen valve can nearly always be distinguished by its card.



SYMONS TEN-WHEEL EXPRESS ENGINE.

Case-Hardening and Annealing.

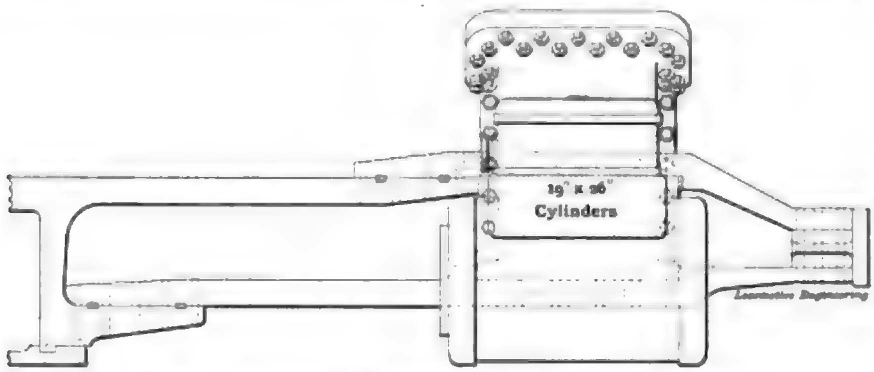
BY FRED H. COLVIN.

One of the first shop mysteries which the apprentice runs up against is the case-hardening of small pieces by the tool maker or blacksmith, and in the average shop it remains something of a mystery, as there is very little of it done. The method employed is usually the simple one of dipping the pieces into prussiate of potash after heating to a cherry red, heating again if it has cooled any in the dipping process, as small pieces are apt to, and finally plunging in water. This leaves a hard surface to a very slight depth—perhaps a sixty-fourth of an inch—and is not apt to color to any extent.

The more ambitious way of the small shop is to take a piece of gas pipe of good size, screw a cap on one end, and make one for the other having a few small holes in for vents. The articles to be hardened are placed in the pipe, packed with burned leather, bone, etc., the cover screwed on and kept at a red heat for several hours, depending on the size of piece and the depth of hardening desired. Others make a sort of box of sheet iron, but those who make a business of this work use a cast iron box with a cover. Leather is not being used as much as formerly, on account of the trouble of burning and crushing, although it is said to give good colorings where this is an object. Raw bone is being largely used for this purpose now on account of convenience and low cost, and that prepared by the Rogers & Hubbard Company, of Middletown, Conn., known as "Granulated," seems to be a favorite with many, although there may be other brands in use in other sections of the country.

Case-hardening may be called carbonizing or "steeling" the surface of iron and low grade steel; this on being suddenly cooled hardens just as steel does. That this is true is shown by the fact that pieces of low carbon steel which will not harden by the usual process are used for the purpose of making tools by carbonizing the outside in a case-hardening furnace, with the aid of raw bone or other carbon. Small pieces will become steel for a considerable distance in toward the center in from three to six hours. Larger pieces require much longer, all night in many cases, and the depth of the carbonizing can be easily seen at the end of the piece, the center remaining soft. It is this feature of a soft center that makes this process desirable for some tools, and it is used to some extent by those who use large milling cutters, taps, dies, etc., as well as for drop hammer dies. After a piece is carbonized it is treated just the same as tool steel, showing it to be transformed from low into high carbon steel.

The writer has also seen cases where small milling cutters were made of low carbon steel, the cutters being made complete, as in the case of tool steel and then being case-hardened in the usual way to a depth of possibly a sixteenth of an inch. It was considered cheaper to throw these away after they were ground down so as to be soft than to use tool steel, and as they were mostly form mills, this was probably the case.



CYLINDER FASTENING OF SYMONS TEN-WHEEL PASSENGER ENGINE.

In case-hardening solely for the hard surface without colors, the work need not be polished or even finished, and the only care necessary is to have plenty of bone around the work. Where small work is to be done use a layer of bone, then a layer of the pieces, not letting the pieces touch each other, more bone, etc., filling the top of box with from 1 to 2 inches of bone. If you have any old bone that has been burnt it can be used on top.

After being burned a few times the bone becomes white or lifeless and is of no value—the carbon being practically all extracted. Some mix old bone and new so as to keep a fair percentage of new, and use it over and over; others use till burned white, using the older bone on top and for filling until it is white.

The heat required depends on the work, but a good average is about a cherry as seen in a room which is not very light. This is the heat used by the J. H. Williams Company, Brooklyn, N. Y., whose case-hardening attracted great attention at the World's Fair in 1893. A pyrometer showed this to be about 1,200 degrees Fahrenheit, and everything seemed to be heated very evenly to a nice cherry heat. This seems to answer for all ordinary sizes and need not be exceeded. In this case Brown & Sharpe furnaces are used, with anthracite coal of egg size as fuel. Small work is left in for about three hours, larger work in proportion, the maximum on ordinary sizes being fifteen to eighteen hours, with eight to ten hours as an average for medium-sized pieces. This gives scale or hardening to the depth of 1-32 or 3-64 inch.

A mixture of two-thirds bone and one-third charcoal is used with good results, instead of all bone, some even using one part bone and four parts charcoal for ordinary work, such as cap screws.

Experience in this, as in any line, will give the best of results almost to certainty, for it is not guesswork, although it may seem so to the inexperienced. But as certain causes always produce certain effects, the results are sure in the hands of an expert. As an aid in determining the proper length of time, test pieces are used. These should be as near the size of the work as possible, and are pieces of round stock of the same material as the work, inserted through holes in the box so that the end will reach the center. By using two or three test pieces it can be readily determined when they have been in long enough, as if the first one withdrawn is not hardened deep enough, the second can be tested after an interval of time, and so on with the third. In this way even an amateur can get fair results; but experience is of great value.

The heat should be brought up gradually and held at about the desired point, rather than varied in either direction.

For obtaining the fine coloring which is so much admired in case-hardened work, the work should be nicely polished and perfectly clean; greasy work will not take colors well. The bone should be well charred, which is done by leaving it in the furnace after the fire has been drawn for the night; but it should not be burned, only charred, or else the life is gone.

Mr. Amborn, the assistant superintendent of the J. H. Williams Company, tells me that, for nice work, a mixture of two-thirds bone and one-third birch charcoal gives fine results. It is also necessary to keep the articles from the air until they are cooled, to preserve the coloring. When air strikes the work before cooling, it produces a black or blue-black color that is not pleasing. In other words, the whole boxful, work, charcoal and bone, must be dumped into the cooling tank to get good results. In this way the bone protects the work until it is cooled.

The bath should be of soft water for the best results, and should be kept cool by running water. A sieve hung a few inches below the top of water catches the work and saves time, as, being lifted, all the work is readily picked off and dried.

ANNEALING STEEL.

Although annealing is just the opposite of hardening, it is still closely related, the

same furnaces and materials being available in either case.

In too many cases there is not enough attention paid to annealing of steel for tools, with the result that it is harder to work and is more liable to crack in hardening or in use. It is quite a common practice to have the blacksmith anneal all forgings for tools, and then, after taking a roughing cut, having it annealed again. This softens the steel for the final cutting and helps to relieve the strain of the piece.

down immediately instead of "soaking" at that heat; but the cooling should be very gradual—the more gradual the softer the steel. If it can cool down with the furnace at night the best results are obtained.

With small open fires it is customary to take the piece from the fire and plunge it into the annealing box, filled with whatever the material may be. This is not a good plan, however, as the momentary exposure to the air offsets much of the good that might result from it. Still, where it cannot be avoided, the exposure should be as brief as possible, and the annealing medium should be the best obtainable. In other words, make the best of the conditions which exist, as we cannot hope for ideal surroundings in every shop.

In annealing, a variety of substances are used—lime, sawdust, sand, charcoal and bone. Charcoal stands at the head according to many; others prefer bone or lime, while some, where possible, let the steel cool down in the fire.

Having the iron box as for case-hardening, fill it with fine charcoal, packed around the piece or pieces (and they need not be kept separate as in case-hardening), put them in the furnace and let them heat up gradually to about a cherry, as with the case-hardening, say 1,200 degrees Fahr. It should then commence to cool

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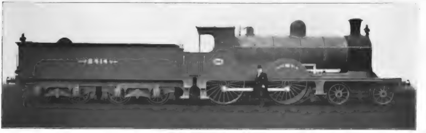
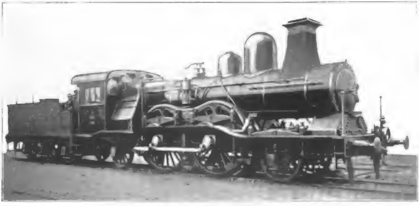
The Chesapeake & Ohio Railroad boasts the longest car float in service. It is used between Norfolk and Newport News, Va., and is 275 feet long. It was built by Harlan & Hollingsworth Company, Wilmington, Del.

Old and New Belgian Express Locomotives.

The engravings shown on this page form a striking contrast for engines built to perform the same kind of service. The railways in Belgium are operated by the Government, but contrary to the most of government-operated railways they are very well managed. Some of the fastest trains on the continent of Europe traverse Belgium, and they are noted for punctuality and comfort. The officials became dissatisfied with the power used for hauling their heavy express trains, and determined to search for something better. After a painstaking investigation they decided that certain engines designed by Mr. John F. McIntosh, locomotive superintendent of the Caledonian Railway, in Scotland, were about what they wanted, and Mr. McIntosh was invited to design a type of express passenger engine that would meet the demands of modern train service. The directors of the Caledonian Railway consented that their locomotive superintendent should do the work asked



M'INTOSH'S BELGIAN EXPRESS LOCOMOTIVE.



OLD BELGIAN EXPRESS LOCOMOTIVE.

of him, and engines were duly designed and built by a Glasgow firm, Neilson, Reid & Co. The engine shown is one of the number, and a good picture of Mr. McIntosh is seen beside it.

The engines have cylinders 19 x 26 inches, driving wheels 78 inches and a boiler that provides about 1,500 square feet of heating surface. The tractive power is 16,840 pounds, recorded by the American Railway Master Mechanics' Association formula. A Belgian engineer, writing about these locomotives, says:

"Regarding the locomotives, we can now assert that the English engines of the Belgian State continue to give all satisfaction regarding the easy starting, powerful traction, and ease for driving. They have thus the great advantage of being able to work the suburban trains, with stoppages and consequently with frequent starts, as well as goods or express trains.

"Their tractive force is better by about 35 per cent. than the engines specially attached to the service of the irregular line to Luxemburg. That is to say, a single English engine can replace two of the old ones, while the tractive effort does not surpass one-third of the maximum, which one of the old engines can give. In other words, if one of these old engines could pull at the maximum 120 units, it required two engines for 150 units, while a single English engine can pull 120 + 40 = 160 units, enough to pull the 150 units. It would, however, probably be easy in changing the firebox of the old engines and in putting on a bogie to transform these engines. The future, in any case, will perhaps prove that other improvements may still be put on the locomotives, either application of compounding or even what seems to be the path of progress, such as multiplication of the number of high-pressure cylinders, so as to produce as continued and constant an effort as possible."

The Transmission Bar as a Means of Increasing Length of Eccentric Rods.

Long eccentric rods, curved over the forward driving axle (which plan is quite common on ten-wheel locomotives), has long been recognized as an evil.

Locating the link just back of the forward axle, and transmitting the motion by means of a curved transmission bar from the link to the rocker located just ahead of the leading axle, is only a slight improvement, because in the former case we have two curved rods and in the latter only one.

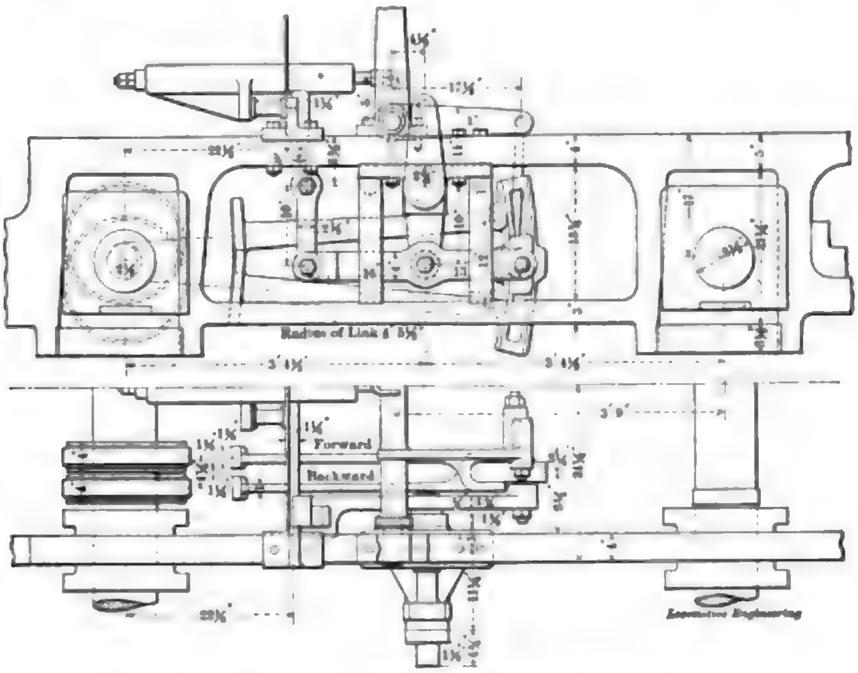
This difficulty has caused designers to go to the other extreme and employ very short eccentric rods, the length being limited by about half the distance between the main and forward axle.

To get away from this difficulty the Southern Railway has adopted the plan illustrated in Fig. 1. This method provides a straight (direct) transmission bar leading back to the rocker. By this means curved rods and transmission bars are avoided and a gain of 12 inches in link radius over the short rod form is obtained.

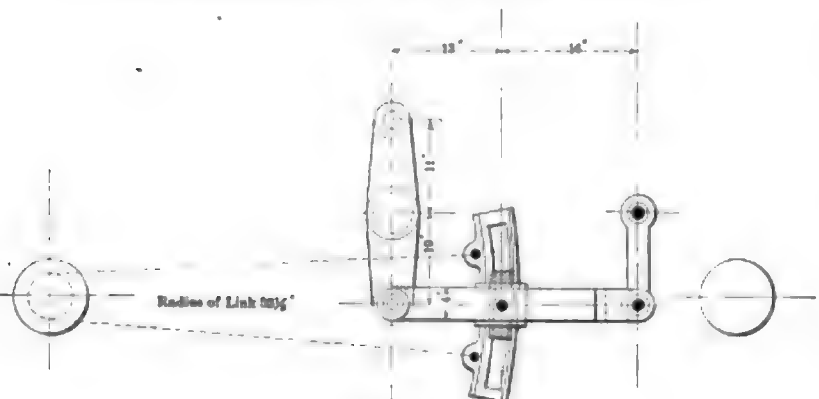
This plan has been slightly modified in engines recently built by the Richmond Locomotive Works for the Plant System, as shown by Fig. 2. This form we consider an improvement over the plan shown by Fig. 1, as all the weight of the transmission bar does not come on the rocker, but is divided between the rocker and supplemental hanger, the rod being supported at the ends.

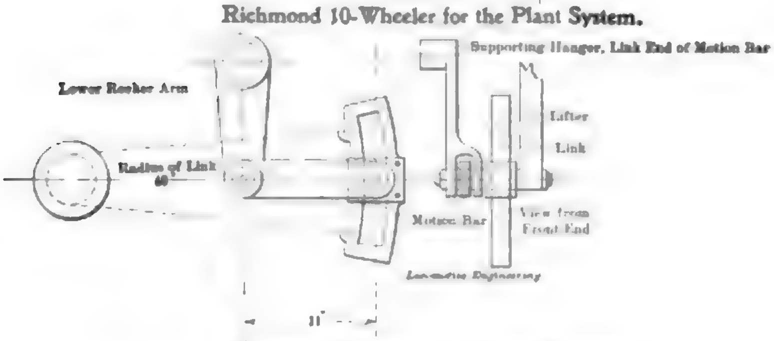
In Fig. 3 we have the method employed by the Brooks Locomotive Works on some consolidated locomotives built for the Long Island and Lake Shore roads. This latter form appeals to us as being both simple and practical, and represents another step in the process of evolution.

It may be interesting to note that this plan was used on some "mogul" engines built by the Rhode Island Works some fifteen years ago.



Link Motion—Richmond 10-Wheeler for the Southern Railway.


Richmond 10-Wheeler for the Plant System.



Brooks Consolidation for Long Island R. R.

Roundhouse Chat—Automatic Railroading.

BY R. E. MARKS.

"What do you think of these automatic engine stoppers, Uncle Billy; these jiggers that set a trigger on the rail when the signal's against a feller, and shuts the throttle, puts on the emergency, wakes up the engineer, sends back the hand brake with a flag and calls out the next station?"

"Anything else, Jimmy."

"Guess that's about all. No jokin', though; what do you think of the thing, anyhow, just for stoppin' the train, without the other frills?"

"Well, Jimmy, p'raps I'm kinder old fogyish like, but I've seen a good many automatic things on railroads in my time, and I can't say I'm dead stuck on 'em either. Generally they don't automat, or else automat when you don't want 'em to. Ef they'd only corral a few brains and mix with 'em 'twould be all right; but brains ain't any too plenty, even among us engineers. So long as we get our living by having a few brains of the right kind for our business, it's probably just as well they don't have 'em on tap.

"Take the automatic stopper you mention. Sposen it works. Have they got an 'unstopper' that will get the train out of the way of the next one, or go back and stop each train so as to avoid a run-in. Then there's an automatic damper they hitch on to the reverse lever so as to close when you hook her up short, and open when she's layin' down in the corner lookin' at you. Praps you might save coal sometimes by spoilin' part of your blast; then again you might want that darned bad some day when the coal wasn't burning free and nice, to keep from getting laid out on the hill. Even if you want such contraption, don't hook it on to the reverse lever.

"Some of these shop men and college chaps who have railroaded on paper more than anywhere else, seem to think an engineer is too ignorant or too lazy or something else to use a good scheme if they don't have to. Well, all the boys don't show horse-sense always, but if most of 'em didn't they wouldn't be running the fast trains they are to-day.

"Take compounds, and here's another place where they've tried the automatic scheme to death. Rhode Island tried it, Schenectady tried it, and that was the only fault of the '1503.' Went into compound before the train was hardly under way, and baulked sometimes in getting a train under way. Rest of 'em tried it too, but they are getting down to business now and leave it to the engineer. They've learned that while it may not be economy from the steam point of view, it pays to work 'em simple at half or two-thirds stroke over a bad hump and save doubling the hill. Can't do this with the automatic feature, as it either goes into compound by receiver pressure, or when you begin to hook up.

"If an engineer knows his business he'll handle them all right—if he don't, he isn't the man you want.

"I've about come to the conclusion that the less automatic you have about a locomotive the better; and if I was running things there would only be one, and that's the safety valve. Course I ain't talking about the air brake now—just the pulling part of the machine."

Old Flue Tubes Used for Fence Posts.

Hundreds of men are now engaged on the railway crossing the plains between Omaha and Denver, replacing wooden fence posts with iron supports. The expense is no greater in the item of first equipment, while in durability the iron post is infinitely superior, and it has the supreme advantage that it does not burn. The iron posts are made from old flues of locomotives, valued as old iron at less than 15 cents each. The cost for preparing them for fence posts does not bring the total beyond 15 cents, the price of good wooden fence posts.

Enormous quantities of these posts are being turned out in the shops of the various railroads in Nebraska. The ends are filled with cement to prevent the interior from rusting, and holes are drilled at intervals to hold the wire. It is believed that a fence thus built will stand for ten years without need of repair, an annual saving of $200 a mile to every road on the great plains, or $100,000 a year in fencing alone for every road with a fenced right of way between Omaha and Denver. Thousands of miles of fences are now being destroyed by the annual spring prairie fires, involving additional loss in the way of stock killed on the open range country.

The Wabash Express Engine.

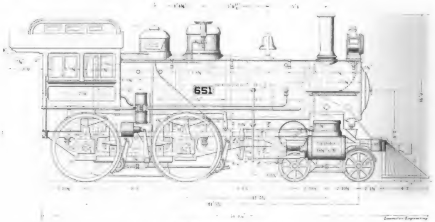
Superintendent of Motive Power and Machinery J. B. Barnes, of the Wabash Railway, has lately finished at the Springfield shop and put in service an eight-wheel passenger engine for drawing their fast trains. It is a Class H, numbered 651; weight in working order 125,000 pounds; 79,000 pounds are carried on the drivers. The boiler is extended wagon-top, radial stayed, 58 inches inside diameter at the smallest ring; a deep firebox; 250 2-inch flues; 165.9 feet firebox heating surface; 1592.6 feet of flue heating surface; carrying 190 pounds of steam. The cylinders are $18\frac{1}{2} \times 26$ inches; drivers, 73 inches outside of tires. All the truck wheels are steel tired. Westinghouse brake equipment is used, with engine truck brake, having a separate auxiliary. The tender holds 4,500 gallons of water and 10 tons of coal.

Some of the excellent features of this engine are the convenient arrangements of all the levers, valves and cocks in the cab, so they can be quickly and certainly operated in an emergency without taking the engineer's attention from the track and signals. The engine has a long deck, so this is much easier done than when a big boiler extends clear through the cab.

BARNES NEW EXPRESS ENGINE.

The duplex air gage has a bracket and lamp on the engineer's side; a separate gage fastened to the front cab sheet is attached to the air signal line. The steam gage and its lamp are on the fireman's side. These two cab lamps at the same time light both sides of the lubricator, which is on the end of the boiler between them. There is not an elbow used anywhere; all the air piping is bent in easy curves and properly clamped to something solid. Where unions are necessary they are so located that they can be got at to tighten up without removing other parts of the engine. The main reservoir holds 32,000 cubic inches, enough to ensure a prompt release of brakes and re-charging of auxiliaries.

She is of a type now fast disappearing,



BARNES NEW EXPRESS ENGINE.

by which we mean a large engine that can be quickly and easily handled in an emergency, and will not take the engineer's attention from the track and signals when handling her. In all her appointments she is finely finished, and Mr. Barnes is justly proud of her.

Boiler Explosions.

In this paper Mr. Gus C. Henning, one of the best posted men in the country on iron and steel, speaks of the causes of boiler explosions and the proper method of investigating them to determine the cause. He gives five causes, presumably in the order in which they generally occur, as follows: Excessive pressure, defective material, low water, defective workmanship, local defects.

By cutting strips from different parts of the boiler and testing them, the engineer who is familiar with the strength of materials can determine the pressure necessary to cause rupture.

Tests for the quality of the material, according to the generally accepted practice will determine this point, as it has never been demonstrated that boiler plate, except when subjected to the action of fire and heat gases, changes its properties by any length of service.

Low water explosions can be detected by the test of the sheets which were overheated, as compared with the sheets which were not overheated. The temperature to which they were heated can be determined by cutting strips from the overheated plate below the water line. These strips polished on the edges are then held in a clear fire so that one end remains cold while the other is heated to a dull yellow or a very bright red. This temperature being reached the bars are withdrawn, and while one is rapidly plunged with one end into a pot of boiling water, the other is allowed to cool in air, but not in contact with wet material or metal or stone. When the piece which had been immersed in boiling water about one inch deep has become nearly cold, below blue heat, it is plunged into cold water.

On the polished edges of both bars will be found scale and heat colors, the temperatures producing them being well established. These bars are then carefully nicked at points opposite every change of color and then broken off at these nicks. By comparing these fractures and their scale and colors with those obtained from pieces cut from the overheated plates, the temperature at which they were at the instant of explosion can be determined with great accuracy. Having thus determined the temperature at which the sheets were during operation, it is also known whether the metal was sufficiently soft to bulge or to strip from the staybolts; examination of plates and bolts will verify the conclusion.

A. S. M. E. Conventions.

One of the largest and most enjoyable conventions of the American Society of Mechanical Engineers was held in Washington, D. C., from May 9th to 12th, inclusive. The president of the society, Rear Admiral Melville, residing in Washington, made it a particularly appropriate place for the meeting, and the reception accorded the members was very pleasing in every way.

The opening gathering at the new Corcoran Gallery of Art and the magnificent reception tendered by Mrs. George Westinghouse in her residence, formerly the Blaine mansion, were both more than ordinarily enjoyable. The latter was the most fashionable function in the history of the society, and the hospitality of Mrs. Westinghouse will long be remembered.

On Wednesday, the 10th, the members and ladies were photographed on the steps of the Navy Department by the Washington Souvenir Company, of 1333 Pennsylvania avenue, from whom copies can be obtained at $1 each. This was a new departure for the society, and the result is shown in the accompanying engraving. There was no discussion on the paper relating to car wheels, due to the late hour at which it was presented, and Mr. Quereau's paper was not presented at all. It would seem advisable to read all papers simply by title, as copies are always sent in advance to members. This would save time and enable more business to be done.

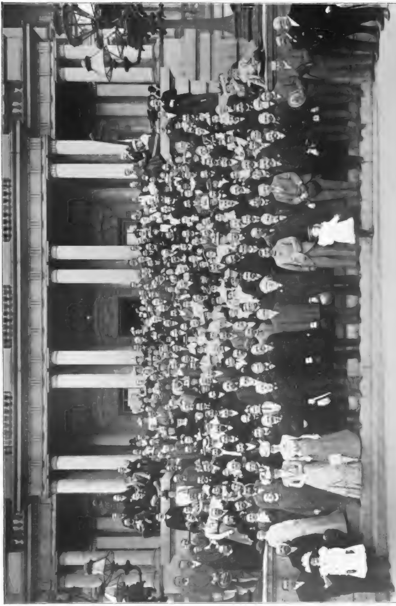


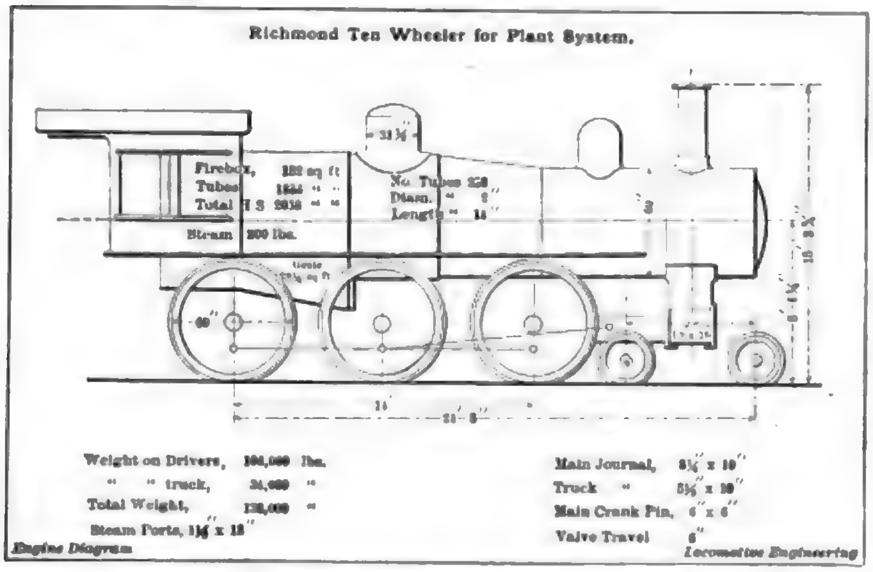
Photo by Leets Bros.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS ON STEPS OF NAVY DEPARTMENT, WASHINGTON, D. C., MAY 10, 1899.

Notes from Lorain, Ohio.

A visit to the Cleveland, Lorain & Wheeling Railway shops at Lorain, Ohio, finds Master Mechanic J. W. Graham very busy with all kinds of repairs. As he is gradually getting the parts of locomotives which need repairs most reduced to a standard, it is much easier done and gives better service. The truck axles and wheels are now brought to two sizes—one for the larger engines and the other for all small ones; same for pilots, smoke-stacks, cabs, brake equipment and oil cups.

One of the features of his machine shop is the use of various devices intended to do special work which the machines were not at first intended for. For instance, on one lathe we saw a driving box slotted ready for the brass; an attachment being fastened to the tool-rest and run by a belt from the counter-shaft above, while the box was bolted to the face-plate.



Richmond Ten Wheeler for Plant System.

Engine Diagram — Locomotive Engineering

Another lathe had a milling attachment for milling out taps and reamers, which was doing good work as fast as a regular machine made expressly for that purpose. These machines will be illustrated later for the benefit of the readers of LOCOMOTIVE ENGINEERING. They were designed and built by J. E. Haynes, machine-shop foreman.

The Cleveland, Lorain & Wheeling Railway Company are now busy in making extensive changes and putting up new buildings at Lorain for the use of the car department, which is under the charge of Mr. F. H. Stark, master car builder.

The old arrangement of buildings and tracks for this work came up a piece at a time, as it could be put in, and as is usual under such circumstances it was not very convenient or economical.

The new plan is more systematic. The buildings, instead of being scattered, are now in one connected line and under one roof. They are located on one side of a long transfer table by which cars can be taken out and put in any of the tracks in the building. In addition to this, the repair tracks for freight cars and tracks to bring lumber and stock into the buildings are connected to a main sidetrack back of the buildings.

The varnish and paint shop is at the east end, then comes a commodious coach shed, where all the work of repairing and building coaches will be done. Next is the wood mill with all the wood-working machinery; then the room for heavy repairs in freight equipment, and lastly a long shed for light repairs with plenty of track room for all purposes. The boiler and engine room is centrally located just back of the wood mill. All the electric-light apparatus will be located there.

As this company is principally engaged in handling coal and iron ore at Lorain, of course there is a lot of work to be done on the docks in the way of repairs, electric lighting at night and unloading machines, which does not come under the head of locomotive and car repairs.

The Cleveland, Lorain & Wheeling Railway are to have three switch engines built by the Pittsburgh people for July delivery, which will weigh about 96,000 pounds, six-wheel connected, 18 x 24-inch cylinders, 44-inch wheel centers, straight boilers, radial stayed, carrying 180 pounds of steam. The tenders will be of generous size, holding 3,500 gallons of water. Westinghouse automatic brake will be used.

An Old Invention Revived.

In our May issue we published a notice of an invention of reciprocating lamps brought out by Superintendent Marston, of the Delaware, Lackawanna & Western. We believed the idea was entirely new and original, but an esteemed correspondent sends us a cutting from the *Locomotive Engineers' Journal* for 1874, in which there is an illustration of Needham's reciprocating signal light, which was then in use on the Cleveland, Columbus, Cincinnati & Indianapolis. Besides the illustration there is a letter addressed to Mr. W. L. Needham, the inventor of the light, which was signed by the general superintendent of the road, three division superintendents, master mechanic, general master car builder and three master car builders. The letter says:

"We regard your reciprocating signal light as an effective and reliable means of preventing rear collisions in cases of trains following or uncoupling. Our conductors and engineers unanimously recommend them as the best rear lights in use for this purpose, and after careful investigation we fully endorse their recommendation. We find a reduction of $24,000 per year in cost of car repairs, a considerable part of which seems due to the use of these lights, twenty-two cars on one division having now been in use two years and four months without an instance of collision. In view of these facts we have no hesitation in recommending them as an appliance of practical value and positive economy."

There are also several other testimonials in favor of the efficiency of the light in preventing rear collisions. It seems to be a very odd thing that a device which was saving $24,000 a year dropped so quickly out of use, for there are few people now who ever heard about it. We are afraid that it was like many other inventions that promised to effect great economy and when applied to practical train service turned out to be very far short of the promises.

Needham, the inventor, was a locomotive engineer on the Cleveland, Columbus, Cincinnati & Indianapolis, but he has been dead a long time.

Manufacture of Car Wheels.

Mr. G. R. Henderson, now connected with the Schenectady Locomotive Works, gave a brief but interesting account of the making of car wheels and the changes that have taken place in the last fifteen years. Chemical analysis was then considered unnecessary; now test bars from every heat are tested both for strength and composition.

The shape has hardly changed, but the strength has decidedly increased. The long life of old wheels may be cited against this, but we must also consider the heavier loads of to-day.

Strength is not the only consideration, however; resilience is also needed to stand the many shocks to which a car wheel is constructed. A certain iron was found wanting owing to a decrease in manganese, although this had not previously been considered of vital importance. It seems to be necessary, however, in order to stand the thermal test, and it also adds strength under the drop test.

As the Master Car Builders' guarantee is forty-eight months, all wheels running over five years can be considered as giving excellent service, and a study of the

analyses of such wheels should be beneficial. Wheels giving a very short or a very long service should be carefully inspected, as they should show the good and bad features more forcibly than in any other way. Mr. Henderson gives the following as a desirable wheel analysis:

Graphite	2.75 to 3.00	per cent.
Combined carbon.	.50 " .75	"
Silicon	.50 " .70	"
Manganese	.30 " .50	"
Sulphur	.05 " .07	"
Phosphorus	.35 " .45	"

Then followed the specifications for 33-inch cast-iron wheels, with which our readers are already familiar.

A BIG LOG.

Railroad Department Lorain Steel Works.

A visit to the railroad department of the Lorain Steel Company will show up some of the neatest switch engines in Ohio. Nine of them are employed in switching standard-gage cars around the yards at the steel plant; all of them work days, and three nights. They are under the direct charge of Master Mechanic B. B. Cargo. During our visit of ten days there we did not see that they stood idle any time, but still they were kept in first-class shape. This is done by looking out for the precept that "a stitch in time saves nine." Repairs are made right along each night as they are needed, instead of waiting till there is a lot of work and taking the engine out of service.

In addition to the standard gage engines there are several others of narrow gage employed in hauling steel ingots from where they are poured to the rolling mills. One of them is up stairs drawing the melted iron from the cupolas to the converters, where it is made into steel. These narrow-gage engines are looked after by the officer in charge of the building where they are working, just the same as the stationary engines are.

A traveling 10-ton crane is one of the busiest machines they have. It goes all over the yard loading and unloading all sorts of material on short notice. It will hitch on to a string of cars and move them easily, at a very slow gait, however.

A Novel Water Trap.

At the Wabash railroad shops, in Springfield, Ill., when they first began to use compressed air extensively for hoists, etc., they had considerable trouble on account of water being deposited in the pipes and working into the air cylinders of the hoists. This caused a great annoyance when it exhausted from the cylinders, as well as spoiling the packing leathers. To do away with this water getting in there some traps were made by putting a perforated partition across 12 x 33 auxiliaries, a few inches from the end, and filling in on top of this partition with steel shavings from the tire lathe. These reservoirs were set on end, the air being admitted near the bottom, below the partition, from the main air pipe, and after passing up through the steel shavings went out of the top to the hoists and presses, one of these traps being located in each shop down on the ground.

It is surprising how much water is drained from each of these traps every day. Compressed air is used in this shop to aid manual labor in a variety of ways, with very ingenious machinery, which will be spoken of later in LOCOMOTIVE ENGINEERING.

A Big Log.

The photograph from which the annexed engraving was made was sent to us by Mr. W. J. McLean, master mechanic of the Bellingham Bay & British Columbia Railroad. Three of these logs make a full load for two trucks of 40,000 pounds capacity.

The new edition of Sinclair's "Locomotive Engine Running and Management" is proving very popular. We are receiving orders at the rate of 120 per month.

Weakness on Applied Mechanics—A Skunk Incident.

BY SAM SHORT.

A month or two ago I called upon my old friend, Allan Johnston, who is the general superintendent, and in fact, general factotum, of a small road in Missouri, who has always been one of my warmest frienos. Having risen to his present eminent position through the mechanical department, he is always on the lookout to discuss the latest fashions in that line, and he has generally received me with a request to tell him all that is new about pneumatic tools, electric motors for driving tools, and in short, the most advanced labor-saving appliances and practices likely to help a struggling railroad to make both ends meet. His usual way was to invite me into his dusky den doing duty as an office, pull out a box of bile generating cigars, inveigle me into ruining my health by burning one, and then inviting an account of what I had seen new since last we parted.

This time he was in a different mood. Although a good Scotchman, with decided impulses towards hospitality, he seemed to forget about the cigar act of cruelty, and on getting seated in the privacy of his den he exclaimed, "Why, Sam; you are the very man I was looking for. You know all about the intricacies of pneumatic, hydraulic, electric and I don't know what other mysterious things that no self-respecting mechanic was called upon to understand in my time, and I thought that I could get along through my life without going into these newfangled mysteries, but they threaten to floor me, and I need help. You were always a believer in the 'Science of Mechanics,' whatever that may mean, and I want to draw a little upon your science."

On being encouraged to explain the scientific mountain that had obstructed his progress, he proceeded to explain that the whole establishment had got stumped with the working of a Watson & Stillman wheel press, and that they were still wrestling with it, and the prospects were that they would have to request the makers to put it in working order, an alternative very humilating to the whole establishment.

"You see," said Allan, "our old wheel press got so far behind the times that after much persuasion I got the president to order the most modern Watson & Stillman press on the market. It was set up without much delay, and went into business, doing about five times the work of the old press, as far as I could figure it out, and dispensing with one man. It had been doing its work for about seven weeks, and I used to stand every day and admire the slick way it pulled off and put on wheels. Well, one day a car of wheels was stopped beside the press, and in lowering one down it got away and smashed some of the small attachments of the wheel press. We have the Watson & Stillman catalogue and have tried to rebuild the parts on the original plan, but —then the press does not work."

"Tom Merrill, the general foreman," my friend continued "has always been drumming into my ears the fact that he is a man of work and not of theory, and the youngest apprentice in the shop knows as much about the malady that appliance is suffering as Tom does, and I believe that most of the men in the shop are rejoicing over his helplessness. I am beginning, Sam, to believe in your theory, that a general foreman ought to know more than any of the workmen under him. Will you go and look at the darned thing?"

I went and looked. Then I tried to operate the press, but it did not send forth its pressure. Then I went into details and found that a certain valve had been seated in the wrong way. When this trifling disorder was remedied the press proceeded to do business with its usual vigor and efficiency.

There are always mixed feelings when an outsider comes in and shows shop officials things they ought to know themselves; but these men did not display much animosity. As Tom Merrill came round and demanded to know why a certain machinist had not examined that valve as directed, the reply was that no direction had been given, and when the general foreman began blustering at the man, my friend Johnston quieted down the trouble by remarking, "Mr. Merrill, I don't think the climate of the place agrees with you. Come around in the morning and I shall fix you out for a trip to St. Louis. You need not come back!"

Hitherto my experience with Johnston had been that when we arrived at his pleasant domicile he would become agressive in his views of my opinions of railroad mechanical practices. This evening he was mild, and even meek. He encouraged me to romp with the children, and seemed delighted that even the youngest made free to pull my beard; but there still remained a depressing influence I could not understand.

After we had played four or five games of checkers, and I came out victor every time, Allan said, "Let's tak' a walk an' cool off. Maybe a'll dae better efter gettin' fresh air." He always fell into his native Doric when excited.

The walk was silent and sombre, and it was not until we returned towards the house that he began to reveal the cause of his annoyance and disappointment. "You see," he remarked as we got near home, "you have always been upholding that International Correspondence School at Scranton and making out that a young mechanic who had not got a fair education before beginning to learn the trade could make himself as good as the best by joining that school. Well, we discussed the question for months, and finally we decided that Alick should enter the school. His lessons began three weeks before the breakdown o' the wheel press, an' I expected that he would tell in a meenit fat was wrang, but deil a thing mair did he ken than the ithers that had never entered a correspondince school."

After considerable argument I succeeded in making Allan admit that a young sawbones who had listened to his first three lectures could not be expected to diagnose a case of typhoid fever and cure it forthwith, and that a mechanical student was in much the same boat. He needed more experience.

This line of argument appeared to comfort my friend, and as we entered his home and the children were still romping about, we both joined readily into the innocent amusements and did our best to induce the fatigue of action that brings sweet repose.

When the children had retired, I expected to be challenged to another game of checkers or to be invited to wrestle with some puzzling mechanical problems, but instead of these my friend opened a box of really good cigars, and as the smoke began to fill the room, asked, "Have you read 'David Harum?'"

I was forced to confess that I had not read the book, although I had heard a good deal about it.

"Well," said Allan, "lose no time in reading it. It is just the funniest book I ever read. There is a story in it about a skunk that reminds me of somthing that happened to myself that I shall never forget."

"But," I objected, "anecdotes about skunks are hardly in the railroad line. Did you try to disinfect your cars with skunk oil, or did you try the bodies to lubricate the journal bearings?"

"Don't try to be funny, Sam. The only railroad connection with the story was that we were all railroaders staying where the thing happened.

"When I came to this country first, things were very bad, and the first job I struck was working in a bridge gang on the Buffalo & Jamestown Railroad. Along with ten or twelve other men I was boarding and rooming in a farmhouse out in the hemlock woods near Gowanda. The house was a poor affair, set up on posts, with an open space under kitchen and dining room. The landlady, who was a good business woman, raised everything she could to feed the boarders, and she devoted great attention to the raising of chickens. So much so, that some of my fellow boarders who had seldom eaten anything more sumptuous than potatoes before they crossed the Atlantic, began to kick when stewed chicken came more than twice in succession to dinner.

"Well it turned out that Mrs. Matthewson discovered that her chicken house was getting disturbed and robbed by midnight marauders, and she set a spring trap to protect her property. One night when

we were at supper a tremendous racket arose under the house, and the most obnoxious odor that ever assailed my nostrils wafted through the room.

"Presently a great yelling and screeching of a dog was heard outside, and we all rushed to the scene of tumult to see what was the matter. It seemed that an animal had been caught in the trap, and that it had taken refuge under the house. A mangy dog that was constantly loafing about the kitchen stove had found out that some intruder was under the house and he went out to investigate. He had put his nose too near the animal's teeth and was seized by the upper jaw. Then he made a rush for the kitchen, pulling the animal, trap and chain. The animal had a good hold and held on like grim death. The dog ran over all the lower rooms, rushed under beds, knocking over things, through between the legs of the cook in the kitchen, knocking her down, and then out into the open air, all the time yelping and screaming, but the animal, which had a dark body and white tail, froze on to the dog's jaw. He made several turns of the yard, and I was surprised that the onlookers did not try to step on the chain and stop the procession. Instead of doing that they rushed away when the pair was approaching, as if a pestilence was hanging to the dog's jaw.

"Being a tenderfoot in those days, the only animals I was afraid of were snakes and bears; so when the circus came around the third or fourth time I jumped out and stepped upon the chain. The procession came to a sudden halt, and I began stepping along the chain to reach the dog's enemy. Just as I was raising my foot to step on the animal with the white tail a charge of odorous liquid struck my left ear. Then a shout arose, saying 'the skunk has hit you.'

"I felt the liquid running down my neck, but my blood was up, and I lost no time in stamping the life out of the white-tailed animal.

"My wardrobe was not very big in those days, and the effect of the incident was that I was compelled for three nights to sleep in the barn."

"Sam, you ought certainly to read David Harum," said my host, as with a pensive, far-away look he started a fresh cigar.

Reducing Speed to 60 Miles an Hour.

We have often heard of slow-down orders that were embarrassing to trainmen, but, as a rule, orders of that kind are necessary for safety. The Wabash Railway people some time ago issued an order of this character which seems to us to be unique. When their Atlantic type of engines was first put into service, the engineers found that making up lost time on a fast schedule was not very difficult, and they were in the habit of "letting her out." One day when President Ramsey was riding on the end of one of these trains, he found that the speed recorder indicated seventy-two miles per hour when rounding a rather sharp curve where the movement was hardly of the gliding kind. Then an order was issued that the speed of trains should not exceed sixty miles an hour while rounding that curve.

A Compressed Air Bull-Dozer.

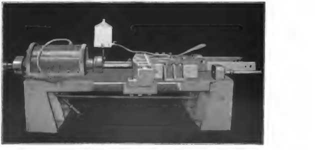
At the Bloomington shops of the Chicago & Alton Railroad they are using a very effective device for bending draw-bar pockets. It is a very difficult job to make a square bend in the short piece that is turned down to catch on the shoulder of the cast stem of the bar.

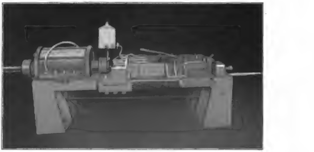
This machine bends these bars very easily. The principle on which it operates is the use of wedges on each side, forced along by the power from the air piston. A sort of cam is forced by the wedge against the end of the hot iron strap and crowds it over with a square bend. It is better explained by the designer, who says:

"I send you under separate cover photographs of air-bending machine and dies for bending lips on the ends of draw-bar pockets. You will notice one photograph shows the dies before operation and the other one afterwards.

"The capacity of this tool is 30 per hour, and they are made out of ¾ x 1-inch iron. You will perceive that we bend two lips at the one operation. This leaves the ends so square and true that there is no hand work necessary after removing from the machine.

"These dies are of my own construction, and if they will be of any service to anyone, I would willingly furnish blueprints of details, at their request."





COMPRESSED AIR BULL-DOZER.

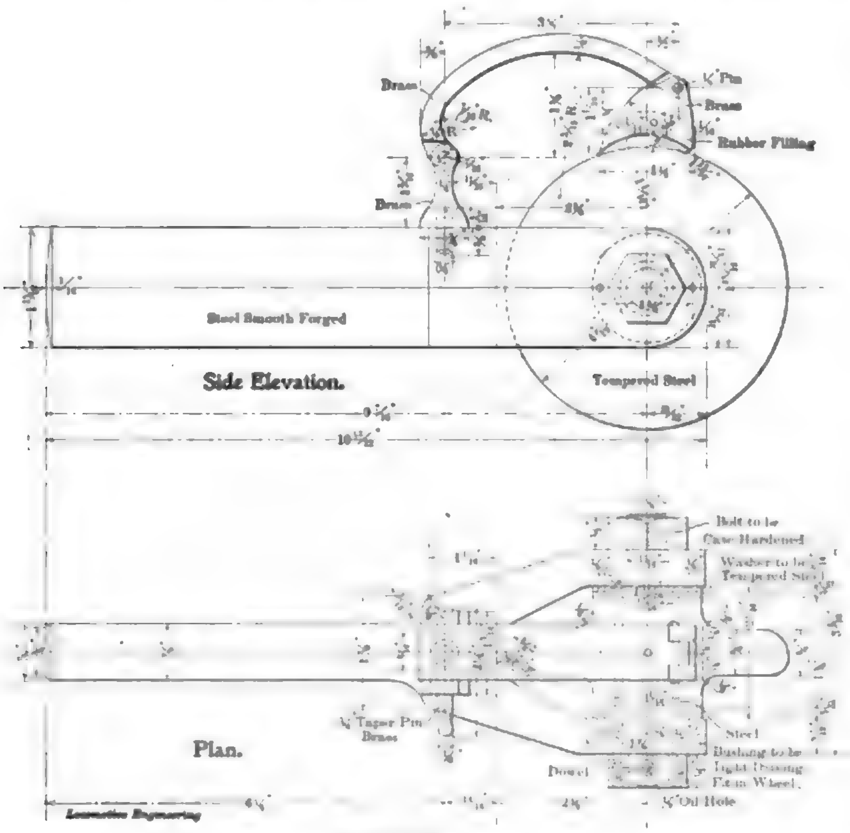
Secretary Allen of The American Railway Association has issued a cheap edition of "The Standard Code of Train Rules for Single Track," as adopted by The American Railway Association at its last meeting. The book is of convenient size for the pocket and costs only 30 cents. As nearly all railroad companies have adopted the Standard Code, this book should be in the pocket of every trainman interested in these rules, and it ought to be carefully studied. The Standard Code has been boiled down into remarkably compact shape, and all its directions can be easily memorized. Up-to-date men need no urging to send for the code and to study its contents.

General Correspondence.

All letters in this Department must have name of author attached.

Burnishing Tool.

We received a letter lately from Mr. W. F. Dixon, of the Sormovo Locomotive Works, Russia, asking for a blueprint of a burnishing tool used for smoothing up newly turned journals. Remembering that Mr. L. Bartlett, master mechanic of the Missouri Pacific, was the first to make a success of the burnishing process, we wrote asking for a blueprint and information about the tool, and received the following letter, which, coupled with the engraving, may give useful information to other shopmen:



BURNISHING TOOL.

"Like the balance of the human race, and myself included, you never write to your friends until you want something. This is quite natural, especially for a man who is busy; but I take pleasure in sending you a blueprint of the burnishing tool which we use in burnishing journals of axles and crank pins. I do not understand why your friend, Mr. Dixon, does not have success if the tool is built properly, and in order to get him straight, I send you print.

"Now as to the speed of the axle, we run anywhere from 100 to 200 revolutions per minute, according to size. For a 4-inch axle we run about 150; any relatively fast speed will answer.

"There is one feature in connection with this that possibly the gentleman does not understand. In treating our car journals we first turn the axle or journal with a water cut and get it smooth as we can in the ordinary way. We then send this axle to the burnishing lathe, which is an old lathe fitted up for this purpose, and almost any old lathe will answer. If the journal is not as smooth as we would like it, we take a fine file and file away any inequalities; but if the water cut is properly made, this is not necessary. We then rub off the dirt and grease from the journal with a piece of leather and whitening or putty powder. When it is absolutely clean, we then apply the burnishing tool, which is held in the tool-post of the lathe, and force it against the journal at one end with quite a heavy pressure, and after we have the roller hard against the journal we put in the feed, say, 1-16 or 1-32 inch, as the case may demand. As the tool moves along the journal, you can feel with the finger the amount of metal that has been depressed by the roller, which amounts to quite a good deal, considering that we are simply compressing the metal.

"One more feature, and a very important one, in connection with this is that you must keep the roller perfectly dry and clean in order to insure success or the best results.

"A little swab is put on the top of the roller for this purpose, which is filled with dry waste and whitening or rubber.

"I trust I have given you enough information or pointers, so that Mr. Dixon will have no further trouble in getting the arrangement to work properly. Should he, however, have any difficulty, I will be pleased to give him any further information he may desire. L. Bartlett.

"D. M. M."

Standing of Engineers in the Navy.

The statement in the article in your May issue, entitled "What Naval Engineers and Firemen Endure," that "the passing of the Naval Personnel bill gives the men who endure the heat and burden of stifling engine rooms and roasting stokeholds the same standing as officers of the line," is, I regret to have to say, altogether erroneous, and indicates that you, in common with probably ninety-nine hundredths of the people of the United States, have been wholly misled as to the purpose and result of the bill referred to. I have no desire, even if space permitted, to discuss the merits of the long-continued strife between the line and engineer officers of the navy, nor do I expect to be supported by those ex-engineer (now line) officers, who seem to have sold their birthright for a mess of pottage. I do, however, wish to present the facts as they are, leaving your readers to draw whatever conclusions from them they may please.

The major portion of "the men who endure the heat and burden of stifling engine rooms and roasting stokeholds" is, of course, made up of oilers, firemen and coal passers, and, so far as these are concerned, their standing is not changed in the slightest degree by the Naval Personnel bill. The other and very much smaller portion of the engine and fire room personnel consists of watch engineers, who, prior to the passage of the bill, were commissioned officers, and they therefore had the standing of officers. The passage of this bill not only does not give the watch engineers "the same standing as officers of the line" but makes them, and they now are, enlisted men, instead of being, as they formerly were, commissioned officers. I do not mean by this

that the bill has reduced the comparatively small remnant of engineer officers who held commissions in the navy at the time of its passage, to the grade of enlisted men, but that it has removed them from duty as watch engineers, and substituted in their place so-called "warrant machinists," who are "petty" officers and enlisted men. After years of persistent effort the line officers have succeeded in their cherished project of reducing the engineer officer to a mere "greaser," and he can no longer stand between the wind and their nobility.

Section 3 of the Navy Personnel bill provides that engineer officers "shall take rank in the line," or "take rank with other line officers"; section 4 that engineer officers transferred to the line shall perform duty "such as is performed by engineers in the navy, except watch duty in the engine room"; and section 5, that engineer officers transferred to the line who rank as or above commander "shall perform shore duty only." Sections 16 and 17 authorize the appointment of one hundred "warrant machinists," whose pay shall be $1,200 per annum for the first three years after appointment, and $1,600 per annum thereafter, and provides that "they shall take rank with other warrant officers according to date of appointment, and shall wear such uniform as may be prescribed by the Navy Department." The other branches of the staff, i. e., the commissioned officers of the pay and medical departments are not affected by the bill, their existence as officers not having proven offensive to the refined sensibilities of the line, inasmuch as they were not associated with machinery, and therefore not classed with the common herd.

Whether or not the complicated high-grade machinery of the present navy can be effectively operated and maintained with "warrant machinists" as watch engineers, and whether or not it is reasonable and consistent to make the chief engineer and every watch engineer of every merchant vessel an officer, as is specifically done by a statute enacted, I think, in 1896, while the watch engineers of the navy are enlisted men, are questions which the public and its representatives in Congress should seriously consider. It is quite evident that they have not yet considered them, and, indeed, it would seem that they are even ignorant that these questions present themselves. Their solution cannot be long deferred, and in my judgment the adroit policy of the line, in bringing the engineer officers either to active or passive endorsement of the Navy Personnel bill by the inducements of increased pay and higher rank will not serve to prevent, in the fullness of time, the restoration of the engineer corps to its proper standing. Suffice it to say that, for the present at least, the watch engineers of the United States Navy are as far as possible from having "the same standing as officers of the line."

J. SNOWDEN BELL.

To Prevent Hot Boxes.

I. B. Rich, in the May number of LOCOMOTIVE ENGINEERING, asks why newly packed boxes run hot.

It has been observed that most enginemen running fast trains dislike having their engines newly packed, and especially if about to make an unusually fast run. It is my opinion that the prevailing practice of packing cellars with newly saturated waste is wrong and that it should be soaked for a number of days before using, so as to approach an "oil bath" as nearly as possible with the use of water, and not depend wholly on the capillarity of the material to carry the lubricant to the bearings.

E. H. BELDEN.

Scranton, Pa.

Cause of Flat Spots on Drivers.

I note in your April number a solution of the problem of long, worn-flat spots on driving-wheel tires by Mr. O. G. Beavers, of Waycross, Ga., and I wish, if possible, to set his mind at ease as to the true cause of these flat spots at this particular point, viz., between the crank pins. This trouble is in no way due to high speed or velocity of the wheels; on the other hand, it takes place when the engine is running very slowly and under the hardest labor. Now, we take the engine with heavy train (either passenger or freight) on a hard pull with rail in an ordinary condition, and as the left crank pin passes the forward center, the right crank pin is down, and as the left crank pin travels a little farther, and until the wheels are about on what is known as the bottom eights, both main rods are inclined down at the back end and both cylinders are taking steam in forward end, thus applying the full pressure on what we would call the top end of main rods. When the latter are in this inclined position this lifts the engine bodily off of all drivers, and while the weight of the engine still remains on the rods, and is thrown to the main drivers, the adhesive force is reduced on all drivers except the main pair, and while adhesive force is increased on main wheels it is not sufficient to keep engine from slipping at this point. I think any practical locomotive engineer will agree with me on this theory; and if anyone desires to test the accuracy of point of view mentioned, they will find that when a locomotive is inclined to slip at all she will slip at this point first. And I have had personal experience in which I have been both amused and surprised to see my engine slip at this particular point and catch the rail again in a little farther travel of the revolution without the use of sand, and let go again when the wheel came around to this point again. And while I have said, and say yet, that the cause of the trouble is in no way attributable to high speed, I have no doubt that this slippage takes place at even a higher rate of speed than mentioned, and when it is not noticeable.

J. B. KINGAN.

Blue Island, Ill.

[We wish to corroborate the argument made by our correspondent. We have often walked alongside the engine when it was starting a heavy train, listening for the cause of some knock, and we noticed that there would be a little slip and then catching at the points he indicates.—Ed.]

Defends American Tools.

I am a very interested reader of your praiseworthy journal, and in studying the columns of the May number I read about those machines in the Lancashire & Yorkshire Railway shops. It is a very nice article, except the paragraph on page 227, which tells about the European shop fine cutting tools, and classing the Americans as a lot of iron pusher-offs.

Now, I am a machinist, and I say this, that if the Europeans can make such nice tools it is a wonder they would not build their own locomotives, and not order so many pushed-off machines, as they are termed, from America.

Another thing is sure, that we seem to push off more and better engines than any other nation, because they seem to be wanted everywhere.

I am not a kicker, but I would like to inform the author of the article that the American shops can cut just as much and just as slick in iron and steel as any of them, and make locomotives that cut equally as well.

V. V. SMITH.

Manistee, Mich.

Quality of Coal Affects Smoke Raising.

Having read all the articles on "Smokeless Firing" in LOCOMOTIVE ENGINEERING since December, 1898, and as it is a subject in which I am interested, being an old fireman and having had experience with several smoke-burning devices, would like to express my views on this subject.

Having fired both marine and stationary boilers, and now firing a locomotive on the Southern Pacific Railroad, my experience has taught me that the kind of fuel used is one of the most important points towards success of smokeless firing. All my work has been done with bituminous coal, Australian, British Columbian or Wellington, Oregon or Nanaimo and Colorado or Castlegate. On the division where I am now employed we use both Nanaimo and Castlegate. The Castlegate coal is clean, will not clinker if fired with even a shadow of care, and as we use the smoke-burning baffler door mentioned by Mr. Petrie, all the smoke that need be seen is when a fresh supply of coal is put on the fire. For you well know that until coal is properly ignited, more or less smoke will be seen at stack; after that no more smoke is visible.

Now, this is not so with the Nanaimo coal; for to get best results from it the

door must be kept shut; for if draught is cut off from passing through grates, or by admitting air on top of fire, clinkers are the result, with all kinds of black smoke. In fact, with this coal we have smoke, no matter how we fire it.

Engines here are all rated according to class, and seldom go over road with less than their tonnage, which is all they can pull and make time. Now, let me ask, when an engine is started with lever in the corner and throttle wide open, of what effect one shovelful of coal will be, that is, one of 18 pounds or three of such as we use, which holds from 6 to 7 pounds. The engineer has to start this way in order to move his train for the Tehachipi Mountain, with its 3 per cent. grade, is not what you might term a picnic to railroad on; so we must have a solid fire and heavy enough to withstand action of exhaust, as well as give heat enough to produce the steam necessary to do the work. In such a case how is smoke to be avoided? While we try to be economical in the use of coal, we cannot under existing conditions claim to be entirely smokeless, and I am afraid we cannot be until some genius will invent a way to bottle up smoke and burn it over again; for having to use two different classes of fuel, which have to be handled differently, but with same grate diaphragms and nozzles it is almost impossible to give same results. We also have eight different classes of engines here, and what would work well with one would be a failure with another. Then all engineers do not work their engines alike. Besides that, engines being all pooled here, we do not get the same engine in same condition twice in six months; therefore have to feel our way on every trip we make. How then can we be expected to be perfect? We have been doing this continuous firing ever since I've worked on the road, and it was done long before them. Now, if Mr. Newsam or any of the other gentlemen who are advocating this method will kindly give us a few practical illustrations which will teach us how we can fire without smoke at all, we will gladly hail him "chief" and acknowledge we have served our time in vain.

While I am a firm believer in smokeless firing as being the best method, and know that all the men on our division are doing their best to fire on this principle, still we have so many difficulties to overcome that it will be some time before we can attain perfection in this line, especially young firemen who may become discouraged and fear harsh criticism if their efforts are not a success, and would gladly receive any information that would help them out. We are all anxious and willing to show the Southern Pacific Company that we will use our best efforts to comply with their wishes in this matter. It is for that reason I have written as I have done. We know that the company is too just to condemn a man because he does not make a success of it right away, and will certainly give us all a fair chance to improve, making allowance for all the drawbacks that stand in our way before we can become experts in that branch of our business. It is undoubtedly a great saving of fuel, and who can blame any corporation for advocating it? They have the same right to do so as any individual has, and as what is for the best interests of employers should be the aim of employés. Where a fair and reasonable request is made, as in this case, we all hope to see the day when "smokeless" firing will be made both practical and easy and bring forth good results.

We would all be glad to hear from some of our brethren on other roads telling us what their experience has been in this line.

415 College St., S. A. F. FRY.
Los Angeles, Cal.

Officials to Blame for Bad Firing.

I have carefully read the article in your May number headed "Resenting Our Articles on Firing," and I believe that every word in it is true. The blame, however, of any resentment against you or LOCOMOTIVE ENGINEERING in the case is not due to any prejudice on the part of the firemen so much as to the injudicious way that the officials try to compel your methods of firing to be followed. In the article you say that the officials of the Burlington, Cedar Rapids & Northern Railway do everything in their power to make it convenient for the men to fire in a continuous fashion; that they have put bell ringers upon the engines and low seats for the firemen, besides having the coal broken up and the draft appliances kept in first-class order. While repeating advice about your methods of firing, other officials pay no attention whatever to the advice given to them. They take the whole of the thing as applying only to the enginemen, and they pay no more attention to providing conveniences for good firing than if they had no interest whatever in the engines.

On the road where I am at present, the coal is dumped upon the tender in lumps that are limited in size only by the ability of the coal man to get them into the buckets. Shovel plates are often in bad order and the grates in such bad shape that they can hardly be used. The firemen, as a rule, are up-to-date enough to assist in every possible way when called upon to do so, but all the encouragement they get from the officials is abuse when they cause smoke or fail to keep the engine hot. Trainmen, as a rule, are always ready to co-operate towards a reduction in expenses if those above them would only do their part in an intelligent way.

There is certainly some feeling against you and LOCOMOTIVE ENGINEERING at present, but I am satisfied that there will soon be a re-action and that God will show the right. JAMES WATSON.
Montreal, Que.

Smokeless Firing Come to Stay.

In your May number I see you are told by your subscription agents that your recent articles on smokeless firing are costing you thousands of subscribers. I enclose you a draft for two American dollars, which was handed me the other day by an official of the "Santa Fé" Railway. He wants your paper, and "there are others" that have read these same articles that would subscribe if they had a chance. Get a hustle on your agents, and it is "dollars to doughnuts" that you get three new subscribers for every one that stops his paper because he thinks bituminous coal can't be fired without smoke. I think smokeless firing has come to stay. It is practical, and I see it done every day on engines with a three-car passenger run, as well as on the "Hog" with thirty-five loads behind her. I would call the attention of those engineers and firemen who are stopping their papers, to an article in the last number of your paper, found on page 200, entitled "Converting Coal Into Smoke"; also to the last line in C. B. Conger's "Plain Talks to the Boys," found on page 203, in which he says "a fair trial will show what there is in it."

Chanute, Kan. A. L. BEARDSLEY.

Firing Without Smoke.

In reading May number of LOCOMOTIVE ENGINEERING I am much surprised to learn that any man in the mechanical department of a road takes any exceptions to your article on firing engines. I think the report of the men that have found any flaws has been magnified. A progressive engineman cannot find fault with a report which contains so much valuable information.

After reading your report I was sent to Cedar Rapids to gather what information and knowledge I could relative to this method of firing. If it would be of any interest to you I will send you a copy of report I made to the company on my return.

We have just as good enginemen on the "Soo Line" as any road can produce, but the science of firing was not so fine as on the Burlington, Cedar Rapids & Northern Railway. On my return from Cedar Rapids, all instructions given to enginemen I have followed as near as conditions will warrant this method of firing, and it is working toward perfection. It has been in vogue about four months, and while we do not entirely eliminate black smoke, it has been greatly reduced.

The "Youghiogheny" coal we use is highly charged with hydro-carbon and is not as free from black smoke as coal from Iowa and Illinois. The engines over which I have charge are mostly fired with one scoop of coal to a fire, and at the end of the first six months I think it will be done exclusively. GEO. H. HORTON,
Traveling Engineer.
Enderlin, N. Dak.

Hating the Teacher.

A man will hear and read some funny things, but for men to leave school because they are trying to teach you something that is absolutely necessary that you should know is one thing I cannot understand. Yet this is just what one does that drops LOCOMOTIVE ENGINEERING, because it is teaching him his business. It is the engineer's and fireman's duty to get all they can out of coal, also shovels, brooms, tools, etc. We would think it too bad if we would see our wives throw away the last third of barrel of flour because it was a little hard to reach. Shovels, brooms and tools are better when new, but use them as long as though we had to buy them, and the railroad will have lots of money that is now wasted. I bet that engineer on the Chicago & Northwestern will not drop his paper. L. W. TIGHE.

Nashua, N. H.

Smokeless Firing Makes Work Easy.

Your editorial on page 213 of May number, stating that the paper has lost subscribers by the educational articles on firing without smoke, astonishes me. I am loath to believe this statement. I know personally that many officials of motive-power departments of railroads have urged the men on their engines to subscribe for the paper for this feature alone, not only from a point of economy for the department, but for the comfort of the patrons who travel on the lines. A constant traveler very soon gets acquainted with the fact that on a certain line he can raise a window for a few minutes without spoiling his linen; while on another line he knows if he indulges in an open window he will be half suffocated. I have known ladies to remark on a clean, nice, smooth journey. Because on a line where the men are well up on smoke consumption, or rather no creation of smoke, they are also up on handling the brake and making smooth stops. While of course one subscriber's money is as good as another's, let him be senator or wiper, but he certainly must be an engineman of small caliber who will be impatient with a series of educational articles that are no doubt read with as much interest by the general manager, if he is a real live man, anxious to master details, as by the ambitious fireman searching for the most modern methods.

The line I am connected with has encouraged subscription to LOCOMOTIVE ENGINEERING. The line wants the best men, and the best men and the thinking, reading ones, who not only want to do good work, but easier work for themselves. The subscribers you have lost, if lost, must be of an ancient assortment who are falling behind the procession and will some day meet a heavy jar that will move them out of the business.

A. T. HOOKER,
Gen. Foreman So. Ry.

Chattanooga, Tenn.

Expanding Nozzles.

In the March number of LOCOMOTIVE ENGINEERING we note your editorial on "Expanding Nozzles." We are of the opinion that this article contains much food for thought for officials of the motive-power and operating departments.

It is a well-known fact that the fuel expense on our Western roads is one of the largest items in connection with their operation, and we think men in charge of such affairs should consider any fuel-saving device that seems to possess merit.

We believe there is no appliance that can be placed on a locomotive that will save as much fuel with as small an outlay as a properly designed expanding nozzle. In our experience, we have found that the chief objection to expanding nozzles has been their liability to gum. This is due to the fact that all expanding nozzles in the past have been under control of the engineer, and have all proved an utter failure on this account. Engineers have so many other duties to perform that it is impossible for them to give the expanding nozzle the attention it requires. The average engineer will reduce the nozzle to where it will steam freely, and leave it in this position; and in one trip, under these conditions, the nozzle will corrode so badly that it becomes inoperative.

We have never talked with a practical man, who did not favor the theory of expanding nozzles, but some have expressed a doubt of its ever becoming a success in practical use. Their opinion is based on their own experience, or the experience of others, who have used manually operated expandng nozzles. Recently, during an interview with a superintendent of motive power of one of the leading systems of the Northwest he informed us that at one time he had several locomotives equipped with a well designed, manually operated expanding nozzle, and while on an inspection tour several weeks later, found that none of them could be operated on account of engineers having neglected to use them. It is our humble opinion that the only way that the expanding nozzle will ever fulfill its mission is by having its operations controlled by lifting arm or reach-rod attachment. We have had several years' experience with this form of expanding nozzle, and find that it is impossible for them to gum up or become inoperative. This has been proved by having several of these nozzles in service for a period of three years.

WALLACE & KELLOGG.

The Pooling System.

Mr. David Davis in a recent issue of LOCOMOTIVE ENGINEERING has expressed himself as decidedly opposed to the modern practice of pooling engines. He evidently views the problem from the master mechanic's standpoint, and bases his argument on the additional expense to the motive-power department necessary to maintain engines under the pooling system.

This subject, to be treated fairly, should be regarded from a higher point of view than that occupied by the master mechanic. Like every innovation, it is looked upon with disfavor during its experimental stages, and prejudice has in many cases been an important factor in delaying, and in some instances wholly preventing the perfection of the pooling system. It is a measure not calculated to promote reduced expenses in the mechanical department, consequently its success will not depend upon its effect on that department.

The advantages of pooling are that traffic may be handled with a lesser number of engines than under the old system, when the engine laid over while the crew rested. If the crew did not rest, but went again and again until completely exhausted, another decidedly forcible argument in favor of "pooling" confronts us. Where the old system still prevails it is a common thing for the enginemen to "stay with their engine" for seventy-two hours without rest, excepting what they could get on side tracks or while going between stations, which must be admitted are just the times that they should be wide awake, if their personal safety or that of the company's property is to be given any consideration. The schedules and orders that have been overlooked or misunderstood, the watches that have run down, the failures to control speed approaching dangerous points, or to see signals in time to avert danger, represent reasons for thousands of accidents, the primary cause of which was the old practice of either compelling or permitting enginemen to work continuously as long as they were able to live. The officers in the transportation department are, in their efforts to locate the blame for these accidents, brought face to face with such facts, and, in looking for a remedy, naturally resort to pooling; not for the humane reason, altogether, which in itself should be sufficient to warrant a change, but rather as a measure of practical economy; for they are in a position to know that the delays and damages that can be attributed to the unfit condition of the enginemen represent an expenditure in comparison with which the additional expense to the mechanical department under the pooling system is trifling.

Mr. Davis says "the engineers are opposed to pooling." If conducted as on some roads that have tried it, there is every reason why they should be opposed to it. Where the engines are kept in good condition it is a blessing. Mr. Davis states that he used to think that all engines of a size and build were alike, but he has changed his mind. It is my opinion, confirmed by long experience, that if there be any practical difference it can be corrected. We, of course, often hear of the "smart" and "logy" engines,

but their difference in most cases consists in the ability of their engineers to advertise their imaginary faults or virtues. Mr. Davis says "Show me an engineer who favors the pooling system and I will show you a man who is an engineer in name only and is afraid to enter the competitive list on his merits." He refers to the competition in economy of supplies.

The more important competition between engineers lies in their efforts to render prompt and efficient service in the handling of trains. Safety and dispatch are their watchwords, and he is indeed a possessor of that confidence which is born of skill if he favor the system that holds up his performance as a runner in comparison with his fellows, practically on equal terms.

The pooling system is gradually gaining converts. It is an inevitable feature of railway evolution. It is the only reasonable solution of the problem of how to utilize the power to its fullest earning capacity, and where the hearty co-operation of all concerned is concentrated to attain the perfection of that system, its success, in the broad sense in which it should be regarded, is assured.

A GRAPHIC STORY OF A WRECK.

THOS. P. WHELAN.

Indicator Diagrams from Symons Engine.

The annexed table gives some particulars of the indicator diagrams on this and succeeding page.

Speed Per Hour	Revolutions Per Minute	Boiler Pressure	M. E. Pressure	I. H. P. of Engine
Miles	Revolutions	Pounds	Pounds	Horse-Power
47	229	160	42.3	721.28
51	249	170	44.0	815.75
60	288	170	43.5	932.86
45	219	170	44.6—C 48.0—O	737.30—C 792.52—O
60	293	170	51.5	1119.46
30	146	165	94.0	1030.84
27	132	156	71.9	706.70
37	180	178	92.0	1233.00
30	146	165	94.0	1032.46
27	132	165	98.0	983.24
32	156	160	106.0	1231.30
25	122	170	118.5	1081.25

"You fellers may think it was hot when you came through; but have you seen George Brady's train? Well, now, it must have been hot where that was. It just came in with all the windows melted out of one side."

And the crowd started down to see it without thinking that a fire hot enough to melt glass wouldn't leave anything but an odor of burnt paint when it came to passenger cars.

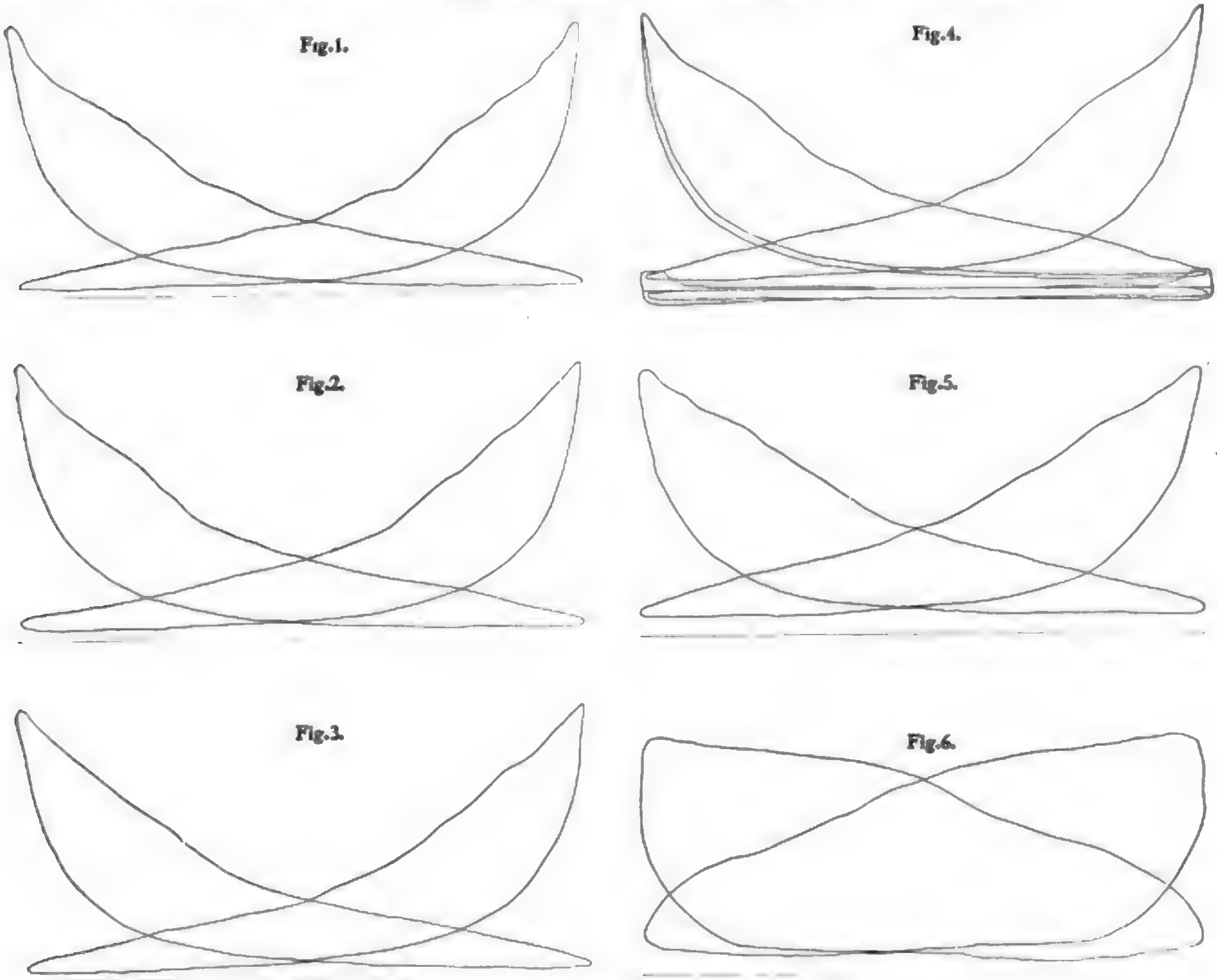
A Signal Device.

It is not unusual for the signal blades governing the passage of trains over an interlocking machine to be so located that a building may be in the back-ground of such a color that the exact position of the signal blade cannot be easily distinguished by the approaching engineer. At the hour between sundown and dark or in the early morning this is especially the case. It is sometimes helped out by raising the post and blade high enough so that the sky will be a back-ground when the engineer gets close to the post.

Division Superintendent Garrett, of the Wabash Railroad, overcomes this trouble by fastening to the signal post a portable back-ground for the signal blade to show against.

It consists of a sheet of iron, the shape of a segment of a circle, with its top edge a little above the top edge of blade when in "Stop" position; so that the blade will show clearly against the back-ground in any position. White is used on the back-ground, as it contrasts better with the red and green stripes on the home and distant signals.

The boys on the road have nick-named this device a "pelican's bill," from its shape, and report it A1 to see the position of blade at a distance.



INDICATOR DIAGRAMS FROM SYMONS TEN-WHEELER.

Melted the Car Window.

Jim Johnson was a joker from Jokerville, but as he didn't indulge in the so-called "practical" kind, which usually hurt somebody or destroy other people's property, he was very popular even with those who were victims. There were heavy forest fires out on the road, and some of the engineers had hairbreadth escapes—if you believed all they told you.

They were telling their yarns when Jim came by, and he overheard them.

The car is a favorite metaphor with certain orators who wish to tell how fast the world or their party is progressing. Sometimes a fervent speaker gives the car attributes that are not its own. An orator in the British House of Commons once exclaimed: "I see a vision float before my eyes—it is the car of progress, rolling on in its majesty, gnashing its teeth as it goes!" Perhaps the gnashing was the work of flat wheels.

Lima Machine and Engine Works.

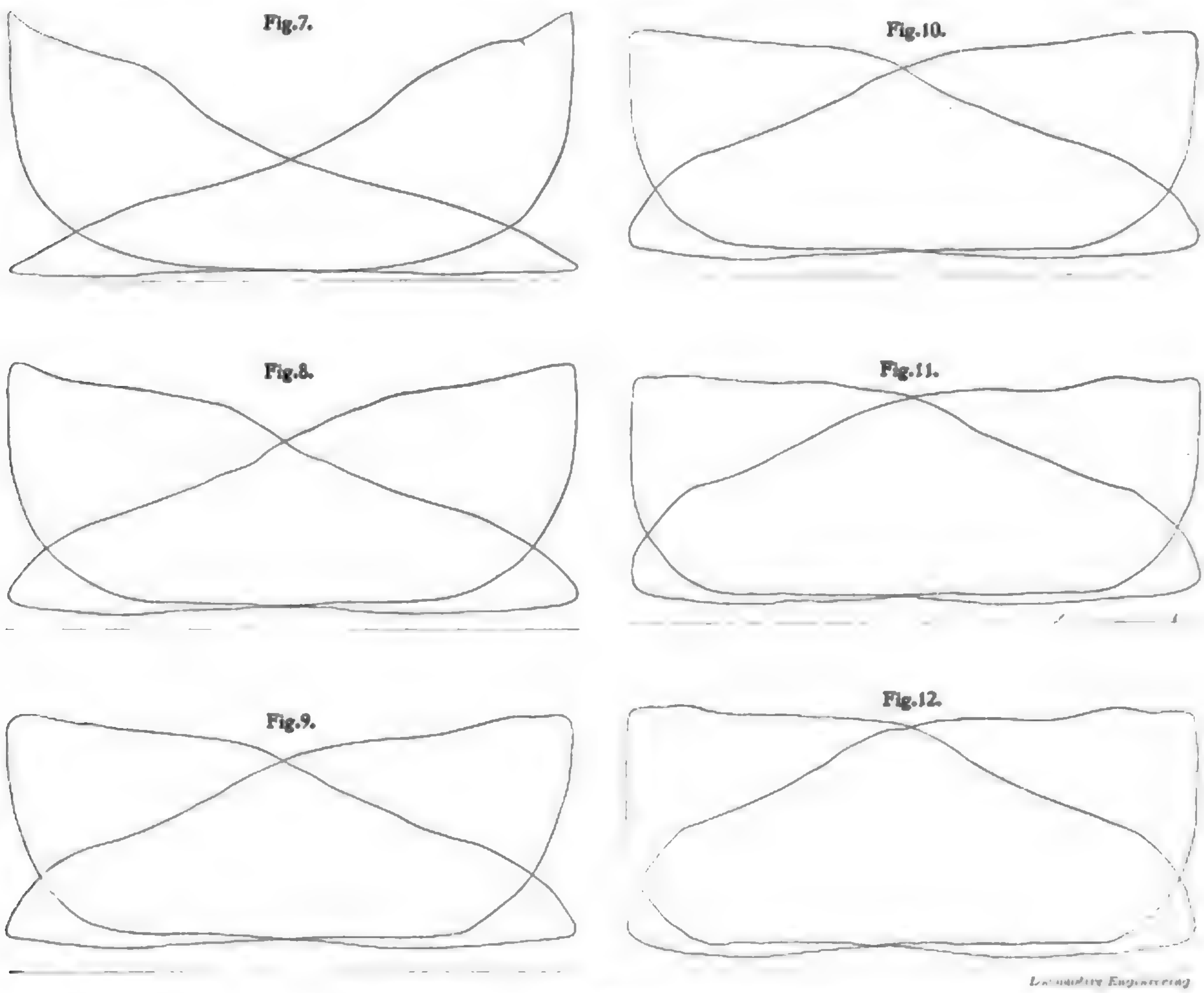
At the Lima Machine & Engine Works in Lima, Ohio, they are busy building the curious geared locomotives called the "Shay" engines, from the name of the inventor. While these engines are calculated for slow speeds and pulling heavy trains over bad grades with abrupt curves and rough track generally found on logging and mining roads, yet they are as carefully built as express engines. Five hundred and seventy-eight is the highest shop number so far turned out. They have orders up to 585.

These locomotives are of all sizes from 8 tons up to 91 tons; the heaviest one yet built being for the Montana Union Railway, with triple engines, 15 x 16 cylinders, geared to twelve drivers, made up of four 36-inch wheels in each of three trucks, one under each end of the locomotive and one under the middle. The engine, boiler and tender all are on one frame, with trucks which can turn to accommodate themselves to any curve like a tender truck. The power is taken from the engines by a horizontal shaft geared to each truck wheel, or, as they really are, driving wheels. About 150 men in all are employed.

The engines run at a high speed, with the three cylinders set at angles of 120 degrees with each other. They are perfectly counterbalanced, so there is no "hammer blow" that tends to shake things up, and they are geared down slow enough at the drivers, so they pull a tremendous load. A great deal of steel, both cast and forged, is used in their construction. The crank shaft and eccentrics are forged solid and afterward fitted into shape. Steel gears are used. These with the universal joints for the horizontal shaft wear out faster than any other parts of the engine, so they are so made as to be easily replaced.

As the three engines are upright, inverted and fastened along the right side of the boiler, just ahead of the firebox the boiler is set a little to one side, so as to balance the weight. This gives them an odd appearance when coming towards one.

These little machines have no superiors for logging operations, as they will go anywhere that a flat car will, are easily handled and last as long as any other locomotive can in such service. The work done on them is as carefully put together as a regular standard locomotive. Where they are used, the operators swear by them for doing lots of work at small cost for repairs.



INDICATOR DIAGRAMS FROM SYMONS TEN-WHEELER.

Rolling Mill Fly Wheels.

While this is hardly in line with railroad work, it is interesting as showing how Mr. John Fritz solved the problem that has caused many a sleepless night to engineers generally. His wide experience in rolling-mill work—the most severe service for a fly-wheel—led him to design a wheel that has given universal satisfaction where used. He used a hollow rim and hollow spokes, and has never had one of them go to pieces—a remarkable record.

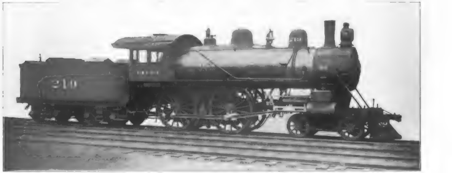
Locomotive for Chicago & Northwestern Fast Mail.

The fine-looking eight-wheel engine hereby shown is one of a number recently built for the Chicago & Northwestern by the Schenectady Locomotive Works for the purpose of pulling the fast mail trains on that road. The designs for these engines were prepared in accordance with specifications furnished by Mr. W. H. Marshall, assistant superintendent of motive power and machinery of the Chicago & Northwestern, and details of the engines were worked out under Mr. Marshall's direction and in consultation with the engineering department of the Schenectady Locomotive Works.

The engines show traces of unusually careful designing, and are likely to prove a great success in hauling fast passenger trains. They are notable for large heating surface, big driving wheels and generous bearing surfaces. The cylinders are 19 x 26 inches, and driving wheels 80 inches diameter. The working pressure of the boiler is 190 pounds per square inch. These figures give the engine a tractive power of 18,947 pounds. The weight in working order is 133,800 pounds, 85,700 of which rest on the drivers. The total wheel base is 24 feet 8 inches, and the rigid wheel base 8 feet 6 inches. The valves are Allen-American, with 6-inch travel and 1¼-inch outside lap. The valves have ⅛-inch clearance, and the motion is so designed and set that there is only 7-32-inch lead when the engine is cutting off at 6 inches. The driving wheels have cast steel centers and the driving boxes are of the same material. The driving wheel journals are 9 x 11½ inches, and the main crank pin journals 6 x 6, while the side rod journals are 4½ x 4. The engine truck journals are 6 x 12 inches. The engine truck wheels are Krupp No. 3 steel tire spoke center, with retaining rings, 3½-inch tire, 36 inches diameter.

The boiler is extended wagon top, 62 inches diameter at the smallest ring. It is built of carbon steel and provides 2353.39 square feet of heating surface. The firebox is 108 3-16 inches long and 40⅛ inches wide, the depth being forward 78¼ inches and back 64½ inches. The tubes are of charcoal iron No. 12 and there are 320 of them, the diameter being 2 inches and length 13 feet. The fire-brick arch is supported by two 3-inch Allison special iron tubes .18 inch thick. The grate area is 30.33 square feet.

Among the equipment of the engine are Dunbar piston packing, Jerome rod packing, Monitor injectors, two 3-inch Ashton open pop safety valves, Westinghouse automatic high-speed air brake on drivers, tenders and front truck; Leach sanding apparatus, Kewanee brake beams on tenders and Star chime whistle.



LOCOMOTIVE FOR CHICAGO & NORTHWESTERN FAST MAIL SERVICE.

The Heaviest B. & O. Train.

When the receivers of the Baltimore & Ohio Railroad began the now famous series of improvements of the physical condition of the entire system, their object was to increase both the trainload and the number of revenue tons per mile, and at the same time reduce the cost of transportation. Much has been done, and by the lowering of grades, eliminating of curves, laying of new steel rails and the purchase of heavy motive power they have very materially added to the number of cars per train.

But it was not until March 17th last that a demonstration was made of what might be expected of the new Baltimore & Ohio road. Enough new 50-ton-capacity steel cars had been delivered to give the operating department a chance to experiment. Fifty steel cars, each weighing 34,000 pounds, were loaded with an average of 98,000 pounds of coal. To them was coupled a new 22 x 28-inch consolidation locomotive weighing 168,700 pounds and having 54-inch driving wheels.

The start was made from Cumberland, Md., and the destination was Brunswick, Md., on the Second division. In his report General Superintendent Fitzgerald says the train was pulled with comparative ease, and that the class of engines used will be able to handle fifty cars of 50 tons capacity each on that division without trouble.

Hitherto the trainload on that division has been 325 units of 6½ tons each, or about 2,200 tons, a 40-per-cent. increase over that of five years ago. The fifty-car train was computed as containing 497 units, or 6,458,100 pounds gross. The net weight of coal in the train was 4,758,100 pounds.

It was by far the heaviest train ever handled over the line, and demonstrated that heavy power, modern equipment with safety appliances and a good track, mean more revenue-tons per mile and a decreased cost of transportation.

Electric High Speed Again.

Electricity, of London, has lately been airing the weak points of the poor locomotive. The writer admitted that it could and did at times "run fully seventy miles per hour," but above this limit the locomotive could not go.

It looks as though our friend had been asleep for several years. We can show him seventy to seventy-five miles an hour any day he comes to New York. Has he read of the fast mail runs on the Chicago, Burlington & Quincy and other roads? All big passenger-carrying railroads have records of 80 miles or more.

The Washington Souvenir Company, 1333 Pennsylvania avenue, have a complete line of souvenirs of the capitol city, such as albums, guides, photographs and novelties. Those who stop over on their way to the convention should get a guide to the city, as it is a great time-saver. They also have catalogues which are sent gratis.

Locomotive Engineering

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Fatigue of Metal Means Too Little Metal.

When a railroad begins to suffer from an epidemic of broken axles or crank pins we generally read attempts made to explain away the source of trouble by saying that it results from fatigue of metal, which is always working to weaken the parts constantly subjected to steady, severe strains or to repeatedly recurring shocks. The investigations we have made into accidents due to the fatigue of metal theory convinces us that the fatigue is fatal only in cases where the crank pin or axle has been originally too weak for the work imposed upon it. When the original design calls for parts with a big margin of safety, they wear without breakage until they get reduced in section so that little margin of strength remains. Breakage may then be looked for.

The conspicuous weakness of locomotive designing in this country has been, making the vital parts too weak, and when the inevitable fracture came about, all the powers of ingenuity have been exhausted explaining the cause of trouble or darkening the mystery that surrounded it. When breakages of crank pins and axles become common on any road, we would suggest an explanation to the experts who are called upon to investigate the cause of trouble. Measure the parts and then report that whereas a margin of safety of five is necessary, through some mysterious act of Providence or the devil, the margin of safety on the finished axle or crank pin was only two, and some unexpected shock overcame that and led the part to grief.

We have come across several pretty good object-lessons that prove some things about weak designs. An axle or a crank pin with a low margin of safety begins to crystallize from movement of the molecules as soon as it enters service, and its weakness limits its life.

The elevated railroads of New York are required to limit the weight of their locomotives to astonishingly low weight per unit of power developed, and every working part has been reduced in weight away beyond the common factor of safety. For years there was a great deal of trouble from broken axles and crank pins. After a time the officials learned what was the average life of these parts, and they arranged to have them changed when their service was a few thousand miles short of the breakage point. Breakages are very rare there now-a-days; but a few hundred pounds added to the weight of axles and crank pins would produce parts that would prolong the mileage two or three times.

Some years ago the Central Railroad of New Jersey bought six switching engines which had axles rather light for the weight carried and for the shocks imparted in running over switches and frogs. There was considerable discussion among the mechanical officials about the strength of the axles, but the engines went into service and bumped over the frogs and switches for several years. Then one day one of the switchers reported a broken axle and was towed to the shop for repairs. Within three months all of these engines had failed with broken axles. Of course it was reported as a rank case of fatigue of metals, but the fatigue would not have proved fatal had there been more metal to resist it. Carrying a load of 40 pounds will soon fatigue into death a man weighing 112 pounds, but a man weighing 175 pounds will find it a light burden.

The Competition of Ignorance.

It seems to us that there is senseless nervousness among many people in this country and in Europe about the future competition between the intelligent producing sons of England and America and that of Russians and Asiatics. The vision has been often seen and declared of shallow-faced Russians, almond-eyed Celestials, and of crafty, smooth-looking Japanese imitating the manufacturing practices of Western Europe and America so successfully on low rates of wages that the whole trade would inevitably gravitate to the cheapest point. We have enjoyed fairly good opportunities of watching the outcome and the relative production of cheap and well-paid labor, and we do not think that intelligent mechanics and artisans who demand a good living from the time they spend daily in the workshop or factory have any reason for apprehension that their earnings will be cut down by low prices due to the competition of cheap labor. There is no artisan in the world so well paid as the American mechanic. The logic of competition is every day demonstrating that the product of our high-paid mechanic is the cheapest to be found anywhere. The trained mental forces directed by our mechanics vanquish the rambling mob of undirected labor just as effectually as our intelligent trained soldiers vanquished ignorance and unskillful shooting in the war, happily about ended.

When American locomotive builders and tool makers and rail makers, and makers of every product that comes from iron ore are beating their competitors in every part of the world there need be no despondency entertained as to the future of our industries depending for prosperity upon the enlightened manhood and sturdy vigor of our citizens. To do a certain amount of work a man must pass a certain amount of nutrition into his stomach, just as a steam engine to compete with another one must enjoy the same amount of heat energy.

In this respect a human being is different from a machine. A good steam engine, worked under the same conditions, will do as much work in St. Petersburg as it will do in New York, but the chances are that the New York brains have had powerful influence in making the Russian engine a success. New York or American brains generally have exerted inestimable influence in the development of the steam engine that turns the wheels of Russian factories, but the same brain power has not reached the Russian workman who must be depended upon to keep the steam engine doing its work. To be sure, the Russian peasant engineer is closely supervised by uniformed officials, who carry in their pockets imposing diplomas from engineering establishments, but the active worker and the supervisor of brass button dignity do not know between them half the needful things for keeping a steam engine or a machine on its good behaviour that are familiar to the humble class of engine attendants to be found looking after the welfare of steam engines, boilers, dynamos, air compressors, refrigerators and other complex machines to be found under the shade of our wide-spread sidewalks.

The men who can fall naturally into doing this class of work have been supplied to an industrial people by a system of natural selection. The history of our citizens as a whole, who have become suddenly rich by lucky strikes in oil, minerals, railroad stock or other speculation does not justify us in believing that all men are born equal. It seems that nature's laws require a course of training to exact the best out of a human animal, just as in

the case of a horse with racing proclivities.

They have learned some things at Hampton Institute, Hampton, Va., about the inequalities of the progeny of the noble red man when he was expected to do ordinary mechanical work as well as the white youths who had a long inheritance of knowing how to do it. Perhaps it would be unfair to compare Russian and Japanese peasants with the sons of our aboriginal races, but the mental progress made by the sires of the two latter races does not convince us that their condition of mental development is much superior to that of our red Indian wards, who will remain a large part of the "white man's burden" for many a year and generation.

The children of our undeveloped competitors are like in action and spirit to many of the overgrown children whose welfare and sustenance our Government has to wrestle with annually and will have to care for until assimilation with a better trained race or annihilation produces its inevitable effect.

The Russian peasant has had generations of training as an agricultural laborer, and while doing that kind of work will follow the long training of centuries and scratch the earth to bring forth some fruits. When he goes out to the world to do the work of a mechanic his connection remains with his native commune, and as he can neither read nor write, no ambition has ever been stirred within him to be anything more than a Mojik. These peasants naturally are deficient in self-reliance, and they continue doing their work as children, depending upon the brass-buttoned official for the threading of the needle. They will go through the mechanical operation of sewing so long as the thread and needle are in working order.

One of the latest manifestations of terror about cheap labor vanquishing that which gives decent daily bread for ordinary human effort is that Russia will become a great marine-carrying nation, and one to produce the stuff to be carried. In regard to this we would say that the peasant of Russia is in almost the same mental condition, so far as sense of responsibility is concerned, as the peasant of Belgium was three hundred years ago. Those in charge of Russian machine shops say that the ordinary workman is so deficient in good sense that he will break a tool one day through careless manipulation, receive the scolding of the boss apathetically, and repeat the damage a day or two afterwards.

That condition of childishness will not be changed for a good many generations under the best aids to development, such as general education. So long as the masses receive no education no nation that has the power of popular education behind it need fear the competition of ignorance. We hear a great deal about imperial ukases ordering the building of railroads, the establishing of foundries and steel plants, and of various manufacturing establishments, but these signs of advancement need alarm no one about the coming industrial independence of Russia. If the Tzar was to publish a ukase establishing a system of common school education, it would be a much more serious menace to our future markets in that country than that of aiding to put up industrial establishments and in the building of railroads.

A Master Mechanics' Laboratory.

A committee of the Master Mechanics' Association is going to report at the coming convention on "A Research Laboratory Under the Control of the Association." That question has been discussed by the association almost since it was organized, but no satisfactory plan could be agreed upon, and we doubt if there will be any better success this year. The railroad companies in the best condition to give a scheme of this kind support have laboratories of their own and cannot be expected to give aid in providing and sustaining a laboratory for their competitors. At one time the association had on their hands what appeared like a white elephant, known as the Boston Fund. Several attempts were made to use that fund in the establishing of a research laboratory, but the mass of the members displayed such decided opposition to the scheme that its advocates perceived that there was no chance of carrying it through. The converting of the Boston Fund into Master Mechanics' Scholarships in Stevens Institute of Technology disposed of that means of creating a laboratory, but its friends seem to be very persistent.

The necessity for a master mechanics' research laboratory was much greater twenty years ago than it is to-day. At that time there were no public laboratories where a railroad company could send material to be tested, but there are several of those institutions in operation now, and they are prepared, not only to test material, but to send experts out to inspect the manufacture of appliances from a rail to a locomotive, or to carry out scientific tests of rolling stock or of any device used by a railroad company. That being the case we cannot see why the Railway Master Mechanics' Association should burden themselves with the expense and responsibilities connected with the managing of a research laboratory. From our experience of associations we know that the average member will devote no time to the details of management. It is with the greatest difficulty that members can be induced to expend any labor on investigating a subject that has to be reported upon. Therefore the labor of carrying on a research laboratory would fall principally upon the secretary, or at least he would be responsible for its successful operation.

There is no more reason why the Master Mechanics' Association should establish a testing laboratory than there is for them establishing a purchasing bureau to relieve the railroad companies from the danger of paying too much for their supplies. Most railroad companies purchase supplies from reputable houses, and are contented to accept the goods on the honor of the sellers. Other companies follow the practice of testing everything they purchase. If railroad companies are too poor to establish laboratories and are not satisfied to trust the honor of the people they buy from, they have the easy alternative of sending specimens of their purchases to Purdue University, to Robert Hunt & Co., Chicago, to Cornell University, or a host of other places where they can get tests made that will be done as well as if they kept their own testing plant.

Making Bad Feed Water Harmless.

We notice that the Master Mechanics' Association is going to be invited to talk on the venerable subject of incrustation of boilers, through the medium of a report on "Boiler Purgers." The subject has been introduced at conventions so often; so many remedies have been recommended and discussed that the education of railroad men about the iniquities of boiler scale and the true methods of reform ought to have been perfected long ago. It is a strange thing, however, that railroad officials will attend conventions, listen attentively to what others have done by mechanical or chemical means to make hard water harmless and then go home to the atmosphere of cracked side sheets, leaky tubes and to all the lamentations that result from lime-infected water and act as if the infliction cannot be cured and must be endured.

Methods for relieving hard water of its destructive effects upon firebox sheets have not been generally successful, not because their use is not effective, but because they have not been given a fair chance. The difference in durability between a clear boiler and one loaded with scale and mud cannot be demonstrated so positively as the difference between a keg of nails and a keg of butter, but the intelligent investigator knows that the difference is positive enough to recommend the clean boiler. The ordinary man does not have the contrast all the time under his eyes, so he neglects the purge that would convert the scale-forming matter into mud, and the mechanical cleaner that would put it outside the boiler. The feed water used by some railroad companies is beyond reform, but the majority of roads would have no scaled sheets or mud-burned fireboxes if they would make regular and persistent use of the means of prevention at their command.

We suppose that the committee on Water Purification and the Use of Boiler Purge will devote lots of time and attention to the whole subject of prevention of

trouble from impure feed water. There is, however, really nothing to investigate. The subject is threadbare. Scale is formed by the depositing, in a crystalline form, of lime compounds which are present in all waters. This deposition results from the destruction of the solubility of the compounds by the heat in the boiler. Certain chemicals may be introduced into the water which will act upon the lime to form other and non-crystalline precipitates. It is these chemicals which constitute the so-called "purges" or boiler compounds. The lime is precipitated by their action in a granular or mud-like form, which will be washed out unless baked upon the sheets by carelessness in blowing off the water while the sheets are hot. There is no question that the purge is efficient if intelligently applied. The same may be said of several mechanical devices used at various times for removing the lime salts from the boilers.

The benefits accruing from scale destroying and removing of scale-forming substances from boilers are: Saving of coal from the better evaporation of boilers free from scale; saving in boiler repairs; prevention of leaky tubes and the delays and expense resulting therefrom; and the obtaining of increased capacity of the locomotive, due to better condition of boiler; and the increased steam making capacity, due to clean sheets; also smaller loss of service for the purpose of carrying on repairs.

While we do not anticipate any new light from the labors of the Committee on Water Purification and the Use of a Boiler Purge, we feel thankful to the Committee on Subjects which recommended that one for investigation. The committee might save themselves useless labor by turning back over the annual reports and copying one of the numerous reports on feed-water impurities, and no one would probably detect that it was not original. It is not new facts that will do any good; it is keeping up the agitation. Most of the men who listen to the reading of the report and take part in its discussion will have forgotten all about it by the time they return to the turmoil of their boiler shops; but a few will remain converted and will go home with a determination to end the iniquities that come from the use of hard water. A discussion or report on how to deal with water impurities has a similar effect to a religious or temperance revival. Many have their hearts stirred and turn towards righteousness while the excitement lasts. Most of them fall back into their evil courses when the emotion-stirring influence is no longer at work, but some of them remain as true converts.

Tonnage and True Rating of Locomotives.

It seems inevitable that tonnage rating will entirely take the place of car rating for locomotives, but the change of system is causing considerable friction in some quarters. The tendency is to overload the engines. Then there is emulation among some yard masters to put as many cars as possible into every train, and the figuring up of the tonnage is frequently wrong, but always in favor of a big train. These practices of course cause dissatisfaction, and we judge from the letters received that over rating of the hauling capacity of locomotives is causing more heart-burning than the pooling system.

In rating the work done by locomotives, we think there is a good deal of merit in the proposal made by Mr. George H. Hodgins, in our last issue, to introduce a ton-mile per hour system. Some divisions are notorious for long detentions of trains on side tracks or at meeting points, and the engine gets no credit for the amount of coal burned while waiting for an opportunity to do useful work. A plan of that kind would prevent injustice being done on the performance sheet to engineers whose bad coal record was no fault of theirs.

Corrugated Fireboxes—Flanging Steel at the Brittle Temperature.

A paper on locomotive boilers was read by Professor Wade Hibbard before last meeting of the New York Railroad Club which excited considerable discussion. The author had been studying the parts of locomotives which called for most attention to keep up and repair. He had happened upon a hard water district, and found that firebox side sheets were the most troublesome. As a remedy he proposed doing what many railroad master mechanics did twenty years ago; that is, he recommended corrugating the side sheets.

We believe that Mr. Charles Graham, master mechanic of the Delaware, Lackawanna & Western Railroad, was the first man to adopt corrugated side sheets. In 1869 he had two locomotives built by the Rogers Locomotive Works which had side sheets made in that way, and the engines did so well that Mr. Graham proceeded to put corrugated side sheets into all new engines or those requiring new side sheets. At the Master Mechanics' convention, held in New York in 1875, Mr. Graham related the result of his experience with corrugated side sheets and it made a profound impression. The introduction of steel for fireboxes had not been entirely successful, and many master mechanics objected to that material on the grounds that it was badly given to cracking from the staybolt holes in the side sheets. This was such a troublesome defect that every master mechanic was ready to grasp at any remedy, just as the wisest victim of rheumatism will try all sorts of remedies recommended by quacks. The practice of corrugating the side sheets was founded on good engineering philosophy. The Fox corrugated furnace is the best illustration of how greatly the strength of a plate is increased by corrugations, and it was natural to suppose that the practice would overcome the weakness that led steel side sheets to crack.

Within a year or two after the statement made by Mr. Graham, nearly all the railroads traversing calcareous districts adopted the practice of corrugating the side sheets of steel fireboxes. The result was almost universal disappointment. The experience of most of the railroads was that the movement of the side sheets concentrated on the top of each corrugation, and that cracking of the sheets was much more common than it was with the straight sheets. The theory of the corrugations making the sheets stiffer seemed to be all right, but it was not foreseen that the inevitable movement would set up local strains instead of spreading over the whole sheet. We are not aware that any railroad company now follows the practice of corrugating the side sheets of fireboxes.

Another point brought out in Professor Hibbard's paper was very much of a surprise to us. In his investigations of boiler construction he found that it was a very common practice in railroad repair shops to flange sheets or finish the flanging after the sheet had fallen to what is known as the critical temperature of the metal. That temperature is about 600 degrees Fahr., and it is well known that the material is much more brittle at that temperature than it is when cold. In some shops where great care is bestowed on the flanging of boiler sheets a hardwood hammer handle is kept at hand for testing, and if the sheet cools down so that it will not start a flame when the end of the handle is pressed upon it, reheating is at once done.

There was a very exhaustive discussion at a Railway Master Mechanics' convention several years ago about the danger of flanging or working on steel when it was at the brittle temperature, and so much was said and written on the subject that we supposed that all railroad boiler makers had stopped the practice. From inquiries made since Professor Hibbard's paper was read we find that foremen boiler makers of prominent shops are not even aware that there is any particular danger in working steel at its brittle temperature, or even that there exists a brittle temperature. It seems to us that this is a kind of criminal ignorance. We do not expect that working boilermakers should understand the science of their business, but the foreman certainly ought to know that hammering a sheet when it is at a brittle temperature is likely to produce bad effects and ought not to be permitted. If master mechanics and general foremen would watch the rough practices of the

boiler shop a little closer than they do there would be fewer failures of boilers from cracked sheets. But the fact is that the demand for hurried output of work is responsible for a great deal of the inferior boiler making practices which cause so much trouble and annoyance to the men handling and caring for locomotives. In too many shops the only test of a man's ability as a workman is the amount of work he can pass through his hands. The quality of the work receives too little consideration.

It is about time anyhow that the flanging of boiler sheets by hand should cease. When the flanging is done in a hydraulic press the operations are so quickly performed that the sheet is in no danger of falling below the proper temperature. If a railroad company cannot afford to purchase a hydraulic press, those in charge ought to have their flanging done in a shop equipped with modern boiler making appliances.

Cast Iron vs. Steel Tired Wheels.

We consider that one of the most important subjects to be discussed at the Railway Master Mechanics' convention this month is a report on "Cast Iron vs. Steel-Tired Wheels for Passenger Equipment." The most reliable information collected about the relative cost for service of cast iron wheels as compared with steel-tired wheels points to the latter being decidedly the most economical in the end, although they cost more in the start than cast iron wheels. For passenger train service, with the high speeds becoming common and the severe service due to the high brake power employed, the question of higher first cost ought to receive no consideration in such important members of the car as wheels. We never believed that cast iron wheels were sufficiently reliable to be used under passenger cars even in the days of slow speeds and light loads, and we certainly think that with the existing conditions of train service, using cast iron wheels is exceedingly short-sighted policy, to say the least of it. Some makers of car wheels are so careful in the manufacturing processes that their wheels very rarely fail in service, but that is not the rule, and inferior cast iron wheels are too common to have the lives of a trainload of passengers dependent upon their holding together. Even the best of cast iron wheels are liable to go to pieces under certain trying circumstances. A common experience in our snowy regions is for a passenger train to be braked down a long steep grade, where the wheels become so hot that sudden chilling will induce fracture. Running into a snow bank produces the chilling and an accident is likely to result. For passenger service no part of the equipment which provides safety should be used except the best. Steel-tired wheels are generally admitted to be the safest, and therefore nothing less reliable ought to be permitted. We certainly hope that the Master Mechanics' committee will report in favor of steel-tired wheels.

BOOK NOTICES.

"The Steam Engine Indicator." Directions for the selection, care and use of the instrument and the analysis and computation of the diagram. Compiled from the regular issues of *Power*. The Power Publishing Company. Price, $1.50.

There have been so many good books published on the steam engine indicator that we supposed there was very little opportunity for a new one supplying new and valuable matter on that subject, but the book before us seems to have accomplished that. The work is quite elaborate, going into very minute details about the mechanism and attachments of the indicator. Besides giving a great deal of useful information concerning the application and use of the indicator, it has a great deal of valuable information on steam engineering which cannot fail to prove interesting to students or readers. A novelty in this book is a transparent chart, giving hyperbolic curves for steam engine indicator diagrams. This will be a great time-saving diagram for men who have to calculate the various data found on diagrams. A variety of useful tables are also given, and numerous methods are provided for shortening up the work of calculating the diagram. The book is written in a plain, intelligible manner, there being little in it that a man who has received a common school education would not understand.

"Steam Boiler Practice in its Relation to Fuels and Their Combustion and the Economic Results with Various Methods and Devices." By Walter B. Snow, S. B. John Wiley & Sons, New York. Price, $3.

This is a highly practical book and contains a great amount of information that will prove exceedingly useful to those in charge of steam plants and to engineers seeking to find means for increasing the efficiency of steam boilers. The book deals principally with the results obtained with boilers under varying circumstances, and of the efficiency of different appliances. The principles of combustion are discussed at considerable length and in a manner simple enough for any ordinary engineer to understand. Fuels of different kinds are treated exhaustively, and the tables giving the analysis of coal from nearly all parts of the world constitute a highly valuable feature of the book. The heat value of nearly all other kinds of fuel is also tabulated. There are chapters on draft, on chimney draft and on mechanical draft, all of which make interesting reading and will be found useful for reference.

So many books have been published about steam boilers that we thought the subject threadbare, but Mr. Snow has in this work proved that there was room for another. We are inclined to think that it will take a place very near the top.

"Liquid Air and the Liquefaction of Gases." By T. O'Conor Sloane, Ph. D. Published by Norman W. Henley & Co., New York. Price, $2.50.

This is a book of 357 reading pages, well bound in buckram, which gives in a clear manner the method by which air and other gases are liquefied. The work of Natterer, Davy, Faraday, Pictet, Cailletet, Dewar, Hompson, Linde and Tripler is shown, and much information can be obtained from it. It gives more information as to the methods employed and the results obtained than any book we know of. In fact, it is probably the first which collects these data and presents them in a concise form. The various illustrations show how the different experimenters constructed their apparatus, and should be of value to anyone who wishes to dabble in the production of liquid air or gases. It contains portraits of Faraday, Pictet, Cailletet, Dewar and Tripler, and its seventeen chapters seem to be well selected and are very readable.

We listened to a rather interesting discussion in our office lately between a master mechanic and a locomotive builder. The design of a huge locomotive built for mountain service alone was under discussion and the master mechanic asked: "Why did you not make these engines compound? That seems to me the best kind of service for a compound." "Well," said the builder, "that was the case where the engine would work two or three hours a day. The saving of fuel was not of nearly the same importance as doing maximum pushing work and being easy to handle. If the engine had been required for continuous heavy service we should have recommended compounds, but for short intermittent work we recommend a simple engine every time."

The June number of the *Pall Mall Magazine* contains an article of great personal and historic interest by the Hon. William Waldorf Astor on the founder of the family in America, John Jacob Astor. The article traces the stirring and tragic incidents which led to the adventurous settlement of Astoria, and many details are given of the foundation of the Astor family in America. The article is illustrated from unpublished drawings, portraits, etc., and is of exceptional interest to American readers.

Mr. A. S. Carey has resigned the position of general foreman of machinery department of the Spokane Falls & Northern, to become general foreman of machinery department of the Union Iron Works, Spokane, Wash. He is a warm friend of LOCOMOTIVE ENGINEERING.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Coach Brake Beam Springs.

BY C. B. CONGER.

Why it is necessary to have springs on coach trucks to hold the brake beams and shoes away from the wheels, is not very clear to the average air-brake man. With coach equipment the cylinder lever is connected to a crosshead which is fastened to the piston rod, so that when the air is released from the brake cylinder, the release spring which pushes the piston back ready for the next application, also pulls the lever with it; and this, in turn, moves all the other levers so that the shoes come away from the wheels at once.

With freight equipment it is different, as the push-rod is not connected to the piston in such a manner as to be drawn back when brakes are released. This leaves the shoes against the wheels till the car body moves on the trucks at the moment of starting the train, and the levers and rods slide along on their bearings so the shoes move off a little, but do not clear the wheels till the train has moved quite a distance. It is not unusual to see engineers reverse the engine and surge back on a long air-brake freight train, "to jar the shoes loose," as they term it.

With coaches it is not unusual to see these springs so stiff that it takes considerable brake power to overcome their resistance and bring the shoes against the wheels. Unless they are all alike, the stiff ones pulling against the weaker ones hold the shoes next the weaker springs against the wheels, so it is a steady drag on the engine from one stop to the next one. It is a rare thing to find these springs so set that they balance each other; even in case they do, the thin shoes are away from the wheels and the new shoes hard against them.

Careful tests made by the writer showed that most of these springs required a piston pressure of from 6 to 8 pounds to bring all the shoes against the wheels. One Wagner car required 8 pounds for two beams and 12 pounds for all the others; so that 8 of the 50 pounds was used by the springs and did no braking. It is an easy matter to make these tests. A good idea can be gained by setting the coach brake by hand and see about how much man-power it takes to get the last pair of shoes into working position.

On the Chicago & West Michigan and Detroit, Grand Rapids & Western roads, Mr. Haskell, superintendent of motive power, had all these springs taken off certain trains about two years ago, with such good results that all the brake-beam springs have since been removed.

The shoes come away from the wheels when the piston starts back in the cylinder, and do not drag between stations. This, in a measure, makes an easier pulling train than if one or two sets of shoes on each car are held against the wheels. It also increases the brake-power without carrying any higher pressure or increased leverage, as well as allowing correct calculations of braking power to be followed out.

New Air Cylinder for 9½ Inch Pump.

The type of air cylinder as shown in the accompanying cut permits a more ready dissipation of heat, owing to the

NEW AIR CYLINDER FOR 9½-INCH PUMP.

greater exposed area of the outside of the cylinder to the atmosphere, due to the corrugation. The air pumped will be cooler, and the efficiency of the pump correspondingly increased. A number of these new cylinders are already in use, and giving satisfactory results.

Sixth Annual Report of the Air-Brake Association.

Probably one of the most instructive and interesting books on air brakes yet gotten out by the Air-Brake Association is its report of the Detroit convention, which will be on sale about June 15th. The most valuable features of the book are the reports and discussions of the papers on "Steam Heating," "Handling Long Freight Trains," "Increasing the Efficiency of Air Pumps," "History and Record of the High-Speed Brake Up to Date," and "The Pressure Recorder as Applied to Air Brakes." In addition, the master car builders' code of triple valve tests and the air-brake men's progressive form of questions and answers have been placed in the addenda at the back of the book. This is a book that goes out highly recommended, and should be in every air-brake man's library.

Inside Hung Coach Brakes.

Mr. John McKenzie, superintendent of motive power of the New York, Chicago & St. Louis Railroad, in rebuilding coach equipment changes the brake rigging on the truck so the beams are hung inside the wheels. The brake beam hangers can be considerably longer than with an outside hung brake, which is an advantage, as they do not change their angle as much with thick or thin brake shoes, or when steel tires are turned down, so the brake power remains about the same.

A more decided advantage is the absence of the strong surge, caused by the tilting of the truck when beams are hung from its outside corners, this surge taking the most effect just at the instant of stopping, and requiring skill on the part of the engineer to avoid.

These same trucks have an improved design of truck hanger, intended to counteract the sideways motion of the bolsters and yet give a free action on curves. The writer took a long trip in one of these cars lately and can say that it rode better than one of the old style in the same train.

The report of the proceedings of the Air-Brake Association's sixth annual convention, held in Detroit, Mich., April 11th, 12th and 13th, is now in the press, and will be on sale about June 15th. The price will be the same as in former years, viz., paper bound, 50 cents, and leather bound, 75 cents. Be sure and get a copy, as this is one of the best books the Association has yet put out. Send orders to F. M. Nellis, secretary, 95 Liberty street, New York.

CORRESPONDENCE.

Houston & Texas Central Railroad Company's Air-Brake Instruction Car.

Editor:

The car, the photographs of which I send you herewith, was taken from one of the ordinary passenger cars and remodeled for this purpose. It was rebuilt and equipped under the direction of Mr. S. R. Tuggle, superintendent of motive power and machinery.

At one end is the office, 10 feet long, with a berth and desk and other suitable arrangements. At the other end is the boiler, with the coal tank on one side and the water tank on the other. These tanks are made in a triangle form, so as to give more room around the boiler. We have the full equipment for driver brake, tank brake, passenger brake and ten freight brakes, with all necessary valves and gages in working order on one side of the car.

Overhead are the full piping and valves for ten cars of signal. On the other side are all of the sectional, and complete parts of the air brake and all the others.

The dynamo for the headlight is also used for the incandescent lamps, and as there are thirty-eight of them, they make the car very bright at nighttime. There is a working model and full working equipment for the steam heat. The car can be heated either from the boiler or train.

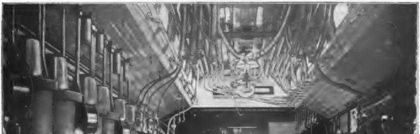
The car is lighted with Pintsch gas, and also oil lamps and incandescents. It is supplied with camp stools. We have also blueprints and drawing—in fact, nearly everything I could find that might be a benefit in this line of information.

We have the ten freight brakes arranged so as to give them any travel from 3 inches to 11 inches, and this can be done in a few seconds. There are several other arrangements which show the defective working of any part very plainly. We have arranged and put up all of the apparatus in the car so as to give as much practical information as could be shown.

To sum it all up, the car will show the air brake, steam heat, electric headlight, Pintsch gas, bell-ringer, air sanders, lubricators and injectors. The car is painted in a very light color, so as to give more light, and the air-brake equipment is painted similar to that of the colored air-brake chart.

JOHN HUME, JR.,
Instructor, H. & T. C. Ry.

Houston, Tex.



INTERIOR VIEW OF THE HOUSTON & TEXAS CENTRAL AIR-BRAKE INSTRUCTION CAR, LOOKING TOWARD THE OFFICE.

Ice and Water in Freight Brake Cylinders.

Editor:

Some roads have experienced trouble with brake cylinders on hopper bottom coal cars where the cylinders are located at the outer edge of a car on the side sill. It seems that in ascending a grade in rainy weather, the rain strikes the piston sleeve, follows down the sleeve and lodges in the brake cylinder. In cold weather, the water so entrapped freezes, rendering the brake inoperative.

To avoid this trouble a ¼-inch hole is drilled in the bottom of the cylinder at the opposite end from which the piston rests in release position. In descending a grade the water settles in the end of the cylinder in which the hole is drilled and escapes to the ground. The hole is drilled so close to the fillet that there is no chance whatever of the hole affecting the operation of the brake, even if the piston traveled out full stroke.

R. H. BLACKALL.

Oneonta, N. Y.

Don't fail to get a copy of the Air-Brake Association's Sixth Annual Proceedings.

Placing Blame for Slid Flat Wheels.

Editor:

Mr. E. W. Pratt, in December issue, under head of "Slid Wheels," says that observation has shown that the poorest air-brake men, those who use the most air—even to a waste—and the most sand are the least often guilty of wheel sliding.

In connection with this the writer would like to ask if engineers who are poor men with air, who are habitual users of sand at all speeds, etc., and whose service application position is nearly midway between the proper service application and direct application positions, could not be guilty of sliding wheels, and the master mechanics justifiable in disciplining them for so doing?

Such engineers do not use this half-way position spoken of above, because they have wasted their air by repeated applications and releases, and expect it to make the stop at the point desired, but rather because it is their habit to run in too close to stations before making the initial reduction, and on finding they are to run by, use this position to get a heavy reduction in a short time, almost at times urging on an emergency application. Are not such men more liable to damage

Again, is not the man who carries a train line pressure 10 or 15 pounds higher than standard, viz., 80 to 85, and gives and receives trains to and from those who carry but 70, with cars equipped with air apparatus intended to be used with 70 pounds as a maximum pressure in train line, accountable at times for a sliding wheel?

On the other hand, are engineers to be wholly blamed on roads where brake-gear parts have not been systematized or reduced to a standard, where a repair man, in case of breakage or loss, is liable to replace a broken lever, for instance, on one truck by one so proportioned as to increase or decrease the force applied to the shoes of that truck in comparison with that applied to those of the other truck; and when triples, etc., do not receive the proper attention, are they at fault for such mishaps as slid wheels? K. A. Young,

Port Arthur Route.

Port Arthur, Tex.

[Mr. Pratt no doubt means that a careless engineer, one who makes repeated and useless applications, thereby reducing his train pressure, would flatten fewer wheels than an engineer who is saving of his pressure and has it all on at the end of the stop. He could not defend the practice of using the position half way between the service and emergency stop, nor that of carrying too high pressure. The careless interchange of unsuitable levers, which often is the cause of flat wheels, would not be permitted on roads where air-brake maintenance is systematized, and certainly the engineer should not be made to bear the blame.—Ed.]

INTERIOR VIEW OF THE HOUSTON & TEXAS CENTRAL RAILWAY AIR-BRAKE INSTRUCTION CAR, LOOKING FROM OFFICE.

A Growing Infant Which Has Our Best Wishes.

Editor:

Mr. Charles E. McFall and Mr. Edward Nevins, air inspectors for the San Francisco & San Joaquin Valley Railway, here, have organized the "Claus Spreckles Air-Brake Club," and have a goodly number of members among the car, locomotive and train departments. We hold weekly meetings, at which different subjects are taken up and discussed. This week was on the triple, and we had a triple sawed in section that aided materially in the discussion. We look forward to the day when we will have a complete and modern instruction plant. C. E. Hill.

Stockton, Cal.

Good air-brake instruction cars and plants are now the rule rather than the exception.

Air-Brake Instruction Car of the Lake Erie and Western Railroad.

Superintendent of Equipment P. Reilly, of the Lake Erie & Western Railroad, built an air-brake instruction car at their shops in January last which he is very proud of. One of their small coaches was used for this purpose. It is 47 feet long over all, has a boiler room in one end containing in one corner, next the door, the coal bunker, in the other a water tank. A large double door opens out on the platform, which takes care of the heat in warm weather. There is a solid partition with a close fitting door (shown open in Fig. 1), which keeps both heat and noise out of the class room, an advantage which is appreciated by any instructor who has tried to talk against the noise made by an air pump in the same room.

The class room is 34 feet long, 8 feet 10 inches wide, and has the main reservoir on one side of the end door, with desk, cupboard and lockers for stationery, etc., on the other side. Then comes the brake valve (an F-6, with its gage showing towards the class); brake equipment, consisting of a driver brake, with two 8-inch cylinders, a tender brake, one 10-inch coach brake, and eight freight car brakes, with the full amount of piping, hose and angle cocks, complete, as used in service, which is supported on the back of the rack to which the cylinders are fastened. The "break-in-two" arrangement is in front of the equipment. The hose is kept from flying sideways and hurting someone by clips fastened to the floor and coming up each side and over each hose. Fig. 2 shows this plainly.

The 10-inch coach brake cylinder is equipped with a strap or loop from the head, so that the piston travel can be restricted to various lengths, from 2 inches to 12. All the freight cylinders have 8 inches travel. The car is well equipped with sectional valves; a freight brake complete is sectioned; the tandem triple is connected to the live triple of the tender brake, and in a good place so that you can operate the brake valve when explaining the operation of the plain triple.

The seats for the class, eight in number, are ranged along the side of the car, where all the gages and equipment are in plain view. It is very well arranged to give a class a good chance to both see and hear. Everybody, both officers and men, realize the benefits of this car. Assistant General Superintendent H. F. Bickell takes a great interest in its work. Mr. L. H. Albers is the instructor in charge of the car. He reports good results from the classes.

INTERIOR VIEW OF LAKE ERIE & WESTERN INSTRUCTION CAR.

Concerning the Instruction of Engineers.

Editor:

While reading the May issue of LOCOMOTIVE ENGINEERING my attention was drawn to an article by Jas. Bleasdale, entitled "Locating and Reporting Air-Pump Troubles," in which he criticises enginemen as to their knowledge of the air pump and their ability to report any defects that may arise.

Mr. Bleasdale while writing probably had in mind a few men who may not possess the requisite amount of knowledge to enable them to intelligently report some troubles that may take place; but he should bear in mind that these are exceptions rather than the rule, and he should not generalize from them.

If Mr. Bleasdale will avail himself of the opportunity to visit the instruction car during the time the engineers are being examined, he will find that I expect the engineers to have a very good idea of the pump. The following are a few of the questions we expect them to answer:

How do you start a pump?

Why do you start it slow?

What would be the result if it was started fast?

Why do you close the drip cocks when the condensation has worked out?

How do you lubricate the steam end of a pump, and state the amount of lubrication required?

What is your opinion of a swab?

What kind of oil do you use on a swab? And why?

Will it furnish the air end with about all the lubrication it requires?

Should the air end require a little more lubrication, how do you give it, and state the amount?

Why not give it through the air inlets?

What controls the speed of a pump?

How fast should the pump be run?

Are there any reasons why a pump should never be entirely shut off on the road?

If the pump is subject to temporary stoppage, where will you look for the trouble?

What should be done with a pump in this condition?

If the pump stops how will you determine if the trouble is in the pump or in the pump governor?

Describe the pump and trace the steam and air through it.

How would you detect a leaky discharge valve, and is there anything else that will produce the same symptons?

What would be the result if the valve or cage leaked?

How would you detect a leaky receiving valve?

What would be the result if it leaked?

What action would a stuck valve produce, and how would you loosen it?

How would you test the packing rings in the air cylinder?

What would be the result if they leaked?

What can you do for a hot pump on the road?

Give some of the reasons for a pump heating?

Give some of the reasons for a pump pounding?

Should your pump begin pounding badly where would you first look for the trouble?

Should your piston only make half stroke, where would you look for the cause?

Should the rings in the reversing piston be broken (8-inch pump) how would you remedy it on the road?

If the reversing valve rod or plate is badly worn, what is the result?

Should your pump stop completely, what would you examine first?

What next would you examine?

What precautions are necessary in replacing the top head of a pump?

These and similar other questions are asked in the examinations, and are answered satisfactorily by the men, who therefore cannot be nearly so lacking in knowledge as Mr. Bleasdale's article implies.

JOHN T. GILL,
Air-Brake Inst., C. & G. T. Ry.
Point Edward, Ont.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(37) C. E. McF., Stockton, Cal., writes:

Please give the causes why a D-5 equalizing discharge valve will cause the cars to take the quick action with a service application. A.—The equalizing piston in the brake valve may be dirty and sticky, thereby causing an abrupt opening at the train pipe discharge port of the brake valve; the preliminary exhaust port of the brake valve may have been drilled out; the triple valve may be dirty and in need of oil, and foreign make of triple valves mixed in with standard make will cause quick action.

(38) K. A. Y., Port Arthur, Tex., writes:

What are we to think of the individual who in running up to a water tank very slowly on a ten-wheel engine, light, equipped with outside equalized brakes, becoming stalled by an application of brakes, through no maneuver of his, and upon getting down and looking her over, finds no piston travel or any indication of air having been at work, and has to disconnect brake rods to move engine, to cut out driver brakes and leave them so over seventy miles of road, as if some supernatural power was the cause, when the trouble lay in a too closely adjusted brake and a very bad track, causing shoes to bind on tires and stopping engine dead, when passing over an even rail? A.—Think kindly of him, and get him into the air-brake room for instruction as soon as possible.

(39) G. C., Norfolk, Va., writes:

1. From bottom rod hole to center of hole in fulcrum of dead lever is 6 inches, and between same points in live lever the distance is 8 inches. Will the former deliver as much pressure as the latter. 2. Why not have them equal? A.—1. It all depends, with bottom lengths as given, upon the distance between the fulcrum hole and the hole in the long end of the lever. Both levers will deliver the same pressure if the lengths of the long ends of the dead and live levers are respectively as 3 is to 4. That is, to have both levers deliver the same pressure with the short ends as given, the long end of the dead lever may be 18 inches and the long end of the live lever 24 inches, or 12 and 16 inches respectively, or any other figures so long as they are related as 3 is to 4. A.—2. The live lever is usually the longer one, in order that the top rod passing over the bolster may connect with the lever. The dead lever, in order to fasten its upper end to the bolster, must be shorter.

ANOTHER INTERIOR VIEW OF THE LAKE ERIE & WESTERN INSTRUCTION CAR.

(40) C. E. McF., Stockton, Cal., writes:

Please answer the following questions to settle a dispute: We have a train of thirty cars equipped with Westinghouse quick-action triples, and with a service application, tenth car from the engine goes into quick-action. Do the nine cars ahead of this car also take the quick-action, or only the twenty cars behind it? If the head cars do or do not take the quick-action please give the cause. A.—If the triple goes into quick-action very early in the application, say, some time during the first seven or eight pounds reduction, all the other triples, both ahead and behind this one, will also go into quick-action. However, should this one triple hold off until late in the application, say, ten or twelve pounds reduction, the triples both ahead and behind this one will have already set so nearly full in service that they will not be affected by this one. In other words, the brake cylinders are already so full of air from the auxiliaries that no train pipe air can gain entrance.

(41) K. A. Y., Port Arthur, Tex., writes:

Two 9½-inch pumps, one quite old in service, the other but recently out of shop, each refused to do otherwise than make short, jerky strokes. An examination of reversing valves, their stems, etc., as well as reversing piston, failed to reveal anything wrong. All other plans failing to make these pumps work properly, an exchange of upper steam heads was made, when behold! each started off in fine order. Each pump was connected to same steam pipe, through same governor, while testing them. Nothing apparently wrong with upper steam gasket. Why would not each pump work all right with its own head as well with an exchange of heads? A.—The short stroking of the 9½-inch pump generally occurs when the pump is being started up and the condensation is being worked off. Possibly in changing the heads, the ports and pipes were freed

of water. Inasmuch as the entire valve motion is contained in the upper head, the mere exchange of heads should make no difference, providing the reversing rods and plates and top-head gaskets were in proper condition.

(42) B. C. G., Truro, N. S., writes:

Is there any difference in the amount of air contained in the main reservoir train pipe and auxiliaries at 30 degrees below zero, and, say, 30 degrees above? In this country we have occasional cold "snaps," when the mercury goes down pretty low, and I have noticed that in that kind of weather the pump has to do more work to get the same pressure in pounds. In releasing brakes, even after a moderate application, the main reservoir pressure will drop perhaps to 60 pounds. During the winter in this country the atmosphere is very heavily charged with water vapor, and that may have something, or even all, to do with it. I speak of trains, such as are run here in passenger service, of five, six and seven cars. A.—The same amount of work is required when a given amount of air is pumped and used at 30 degrees below zero as when pumped and used at 30 degrees above zero. The barometric condition of the atmosphere would have more to do with the case than temperature. That is, when the barometer shows the air to be denser, then less work would be required to pump up to 70 pounds; but the variation of the barometer is so slight that it would not noticeably affect this case. When the atmosphere contains much moisture, such as at rainy and foggy seasons, the capacity of the main reservoir will be reduced, unless frequent drainage is practiced.

(43) G. C., Norfolk, Va., writes:

On page 64 the Westinghouse instruction book says: "It is sometimes important to know the distance in which a train should be stopped at a greater or lesser speed, all other things being equal, the distance and speed of any one stop being known. This may be determined by applying the following formula: Multiply the known distance by the square of the speed for which proportionate distance is desired, and divide the product by the square of the speed at which known stop was made." Then follows an example of a stop being made from a speed of 20 miles per hour in 102 feet; and by the use of the formula it is found that at 41 miles per hour a stop can be made in 468 feet. Now, can I take this rule and known speed of 20 miles per hour and known distance of 102 feet and be right in getting the unknown distance for any speed, everything being in good order? You said in LOCOMOTIVE ENGINEERING recently that a train at 60 miles per hour could be stopped in 1,100 feet. By this rule I can only get 918 feet, a slight difference of 182 feet. Please set me right. A.—"Everything else being equal" means virtually that the same train must be used. If, on a certain train, running 20 miles an hour, a stop can be made in 102 feet, the distance required in which to stop this train from any speed may be obtained by the use of the formula. Now, if you wish to use the formula for other trains you must first make one stop, get the speed and distance, and from this stop as a basis, you can calculate all other stops for this train. No two trains are exactly alike. Therefore, to figure proportionate stops of any train you must first know one stop made by that train. Then apply the rule.

AIR-BRAKE INSTRUCTION CAR RECENTLY BUILT BY THE LAKE ERIE & WESTERN RAILWAY.

In our last issue we referred to the engines about to be built by the Baldwin Locomotive Works for the Ottawa, Arnprior & Parry Sound Railway as being equipped with Leach sanders. We learn that this was an error, as Houston sanders were specified.

A Successful Piston Valve.

Master Mechanic Hatswell, on the Flint & Pere Marquette Railroad, at Saginaw, has used for a great many years the Tremaine piston valve, here illustrated by two engravings, with very good results. The rings are such a neat fit on each other and in the spool or piston head that the steam does not get in under them to set them out. The natural spring of the rings is depended on to hold them out against the walls of the steam chest. When the rings are fitted up 5-16 inch is cut out; they are then put in a chuck and closed up tight and the outside turned off to an exact fit for the steam chest. This gives them a perfect bearing at once, so they last a long time. They are 6½ inches diameter after fitting. A set of these rings was in one engine without refitting while the engine made 390,000 miles.

After a few of these valves had run for a long time they were taken out and the ordinary slide valves put back, but as the engines would not do as much work the piston valves were replaced. The illustrations show the construction of these valves. The valve rod is coupled to the valve by a T-head to allow for lateral motion of the rod or valve.

The drawings showing the application of this valve convey a good idea of the great amount of piston clearance inseparable from the use of piston valves and which has militated against their use on locomotives.

Plain Talks to the Boys.

BY C. B. CONGER.

HOT BOXES—METHODS OF PACKING.

One of my friends down in Pennsylvania asks in the May LOCOMOTIVE ENGINEERING why bearings get hot right after being packed fresh with clean waste and plenty of oil. He thinks that "perhaps it's because we are apt to pack the waste too tight in putting in new," and he may be just right.

To begin at the foundation, the packing, by which we mean waste and oil, can be mixed so it is not perfectly saturated. When in that condition it is an easy matter to put it in too tight and at the same time not have sufficient oil next the journal to properly lubricate it.

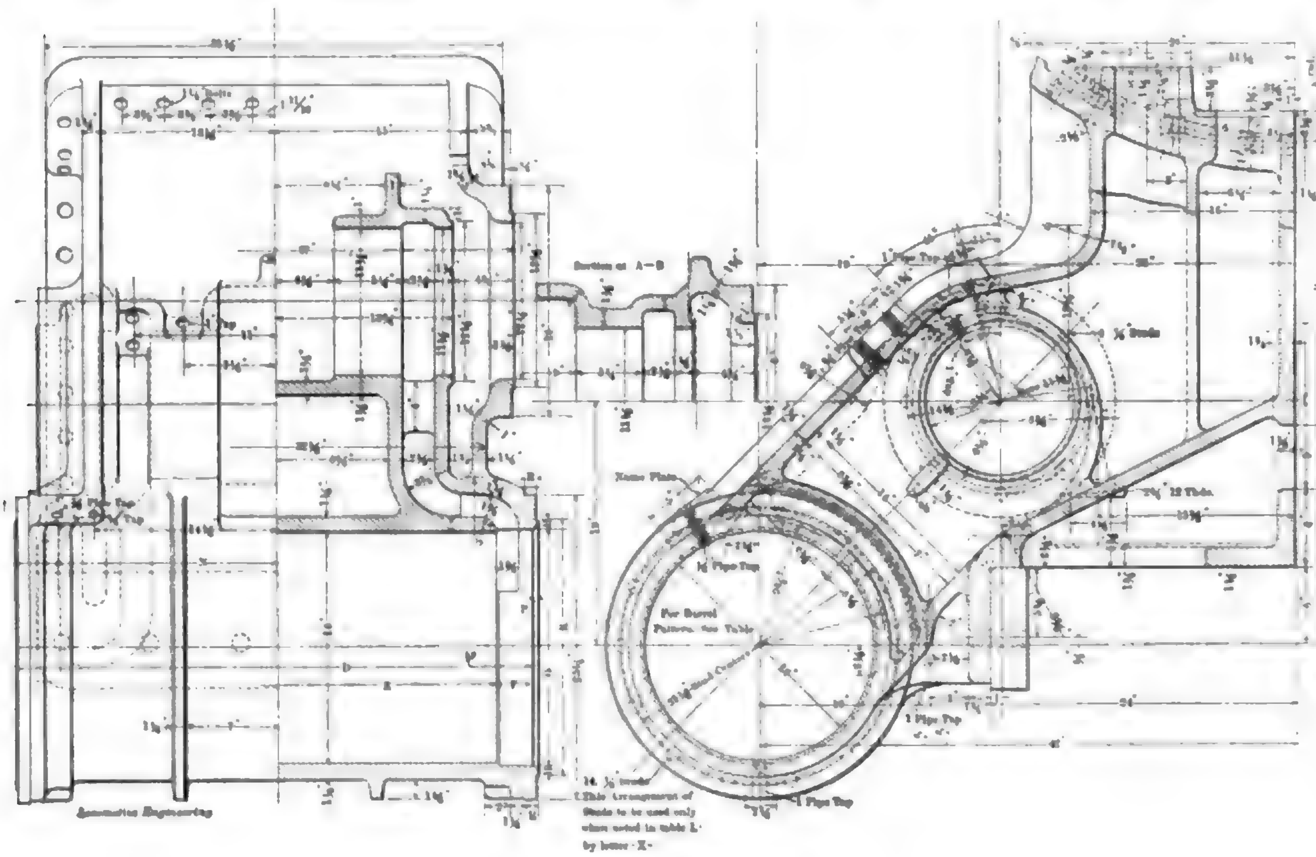
Journal packing, or, as some call it, "dope," whether made with cotton or woolen waste, should first have the waste as it comes from the store-room separated or pulled apart into small lots not larger than a man's fist, so that when it is saturated with oil you will not have to pull out with a packing hook a wad as large as will fill a whole box, drag it across the dirt and grit on the outside of the oil-box, or if it strings out far enough to reach the ground, have a liberal supply of dirt go in with it. Possibly the only dirt that sticks to the packing may go against the journal when the box is packed.

After the waste is properly picked apart so that it can be used economically and handled clean, it should be soaked in the oil till all the fibers are thoroughly saturated and the small spaces between the threads filled with oil. This may take hours, although the process may be assisted by heat.

If the oil is poured on the waste at the last minute before using, it does not get a good chance to soak in and make the packing elastic by expanding it. You can prove this by taking a gallon pail with 1¼ pounds of cotton waste well picked apart, and pouring about 7 pints of oil on it. At first the oil will not all go in the pail, but after letting it stand a few hours all of it can be put in. The next day you will find the packing has expanded or swelled to more than the original bulk; very little free oil is in the bottom of the pail; most of it has gone into the waste.

Such packing will make a good job of lubricating a bearing where it is made up in large quantities. An oil tank is used with steam pipes in the bottom to warm the oil in cold weather.

Then the waste should be separated or picked up in small sizes (we are sorry to say that the man who attends to this does not think this necessary), so that it can be used properly and soaked in the oil till wanted for use. Twenty-four hours is short enough. A rack is provided near the top of the tank for the packing to lie on, and drain off some of the free oil before sending it out into service. This rack for draining is something the trainmen do not believe in. Their test of packing is the amount of free oil they find in the bottom of the dope pail, and if a lib-



TREMAINE PISTON VALVE.

eral supply of oil does not run out of the box when it is being packed fresh, they are sure it is too dry.

N. B.—The oil that runs out on the ground does not lubricate the bearing at any time.

With packing or dope prepared as above stated you are not so apt to pack it too tight, and every thread of waste used is filled with oil ready to perform its full duty.

In the case mentioned on page 207 it is more than likely that something is wrong with the manner of packing, for if the journals had been running cool previously with the old packing and got hot with fresh, new, clean material it would be directly against the experience generally to charge it to the character of the material.

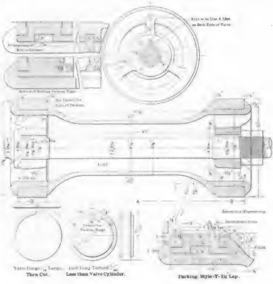
I remember a case of chronic hot boxes on a passenger train where they were packed fresh each round trip by the same man and ran hot each trip. On one occasion after they had all been packed fresh an inspector from another station was sent to examine them and see what would cure the trouble. He pulled all the packing out of the whole lot of boxes and distributed what came out of one car among the boxes of three cars, setting the other two-thirds to one side. There was plenty in each of the boxes, for the journals did not run hot any more, thus proving that too tight packing, even with good dope, was fatal to cool running.

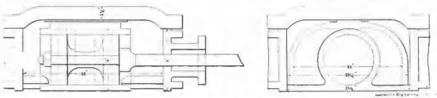
When too much is put in a box and jammed up against the journal, in addition to the extra friction of the waste against the journal, the oil is soon squeezed out, and the waste next the journal is dry enough so that it does not lubricate sufficiently. That is an A-1 receipt for a hot bearing.

When packing has been in a box very long the oil changes its character and becomes gummy on top, so that it does not feed up towards the journal as it should. In such a case removing the layer on top will very often give a fresh oiling surface if the packing is elastic enough to come up against the journal; it is better practice to put some fresh packing in there.

A good deal of the trouble with engine truck and driving axles is caused by the fresh packing winding up behind the journal and wedging in there so solid that it soon gets hot. This is aggravated by the narrow space between the journal and the side of the box. With tender or car boxes there is so much more room at the side that even if the waste does follow the journal it will not very often wedge. As it is not practicable to give any more room at the side in a driving box we have to fasten the waste so that it will not roll up. Some tie it up in a roll so it cannot pull out; others fasten hooks inside the top edge of the cellar. A piece of netting —not the heavy coarse kind—set inside of the cellar, with the top edge turned over with a square corner to catch the waste, is also used with good results. Before you try anything else be sure that the cellar is so fastened that it cannot jolt up and down, wedging the packing when it is up and allowing dust to drift in over it when it is down. It pays to have solid, good fitting cellars and full-sized cellar bolts.

There is a great difference of opinion as to the comparative value of cotton and woolen waste for packing. There is no doubt that woolen waste is more elastic and will bring the oil up to a journal as well as cotton waste. The advocates of cotton waste are sure that cotton right next the bearing lubricates more certainly. So you can take your choice, if you keep the grit out and the oil in.





TREMAINE PISTON VALVE.

To give an idea of the amount of sand and grit that gets in an oil box, take all the packing out of one that has run a long time on a dusty roadbed and burn it to ashes in an iron pan or on a shovel. Then blow away the light ashes of the waste, which will leave the sand and solid matter that has got in the packing. At one such object lesson I saw one half pint of sand from the packing in one Master Car Builder standard coach oil box, and from another box three half pints. None of this sand was put in there intentionally; the dust guards and box lids were in as good order as usual.

Unloading Coal.

To a man who is accustomed to the unloading of coal from cars by the old-fashioned method of scoop shovels, a visit to one of our sea or lake ports, where it is handled more expeditiously, will be a revelation.

At many of the lake ports machines are installed which tip a car nearly bottom side up, so all the coal runs out into a large hopper, which is then raised up till it can be discharged into the hold of a vessel.

At Lorain, Ohio, there is one of these machines, built by McMylers, on which a car of coal is run up on a platform along side of the hopper. Hooks come down and grip the top edge of the gondola, the platform is then elevated and rocked over so the car is tipped over far enough to discharge all the coal. The hooks hold one side of the car from the first start. As it comes up and begins to tip over, chains are drawn down over the other edge of the gondola box and hold the car up against the track, which by this time is nearly over it.

The car is then let down to its first position and another one drawn up on to the platform, which pushes the empty one off. It runs down the incline with force enough to carry it up on another incline, where it stops and runs back through a spring switch on a long track for empties. It takes from two to three and one-half minutes from the time a car comes up on the platform loaded till it is tipped over, comes back again and is pushed off the platform by the next loaded one.

The hopper will hold about two large carloads or three small ones, and when full enough is elevated to the spout into the vessel, and the coal is discharged at once.

Cause of Hot Crank Pins.

At the meeting of the Western Railway Club on May 16 the discussion was on a paper by C. H. Quereau, master mechanic, Denver & Rio Grande Railroad, entitled "Notes on Hot Main Pins." He took the ground that pins got hot from the brasses being improperly fitted, being eased off too much at the top near the joint so that they did not get a good bearing on the pin when running shut off, and in support of this view he stated that as soon as the brasses got a full bearing at the top the trouble ceased. As they found that more trouble ensued with babbitt strips in the surface of the brass, this was discontinued and solid brasses used, which gave satisfaction.

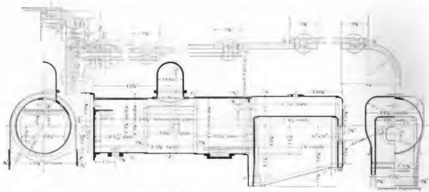
He condemns the use of valve oil for main pins, as it was found that on cold nights valve oil would not feed and pins would get hot. Mr. Quereau's article was illustrated with two cuts to further explain his views.

Mr. C. B. Conger, of LOCOMOTIVE ENGINEERING, opened the discussion by stating that excessive lead in setting the valves would cause hot pins and hot driving boxes. If an engine was worked at a very close cut-off with a wide open throttle that gave more strain on the pin, both at the admission of steam and from the excessive compression at the end of the stroke, but with a moderate cut-off and lighter throttle, there was less danger of hot pins. He agreed with Mr. Quereau that improper fitting was a prolific cause of hot pins, and reasoned that if a pin ran cool before the brass was reduced, and hot afterward, the trouble was caused by poor fitting, or by destroying the fine surface of the bearing when taken down, by filing it out to "ease it off. Another point in favor of having the brass slightly larger than the pin was that it allowed the oil to work down on the face of one half of the brass at the time the strain of the steam is on the other half.

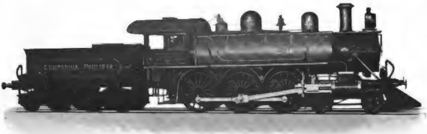
Mr. A. E. Manchester, assistant superintendent of motive power of the Chicago, Milwaukee & St. Paul Railway, said that pins would sometimes run hot after being cool for months. He did not believe in the practice of beveling off the edge of the brass at the top joint, as it was liable to allow dirt to work under the brass and make it run hot. No valve oil should be used when the pin was running cool, as it would not always feed down free; but would use it on a hot pin to get in with. The material in the pin and brass had lots to do with running cool. They prefer the babbitted bearing. He advocated the modern practice of a wedge the full width of the inside of the brass to key up the lost motion, instead of the old style narrow key which was apt to spring the brass in hard service on account of the narrow bearing the key has.

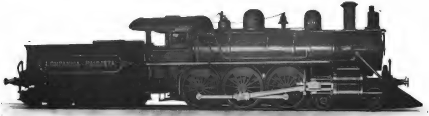
Mr. M. E. Rapp, of the same railway, said they have good results when the brasses are bored a trifle larger than the pin and keyed up solid, brass and brass. In regard to Mr. Quereau's opinion that they get hot when drifting down hills, Mr. Rapp believes that they got hot going up the hill when working hard and are just about ready to show it when they get on the other side. Grease does very well on pins, as it is thick enough to keep out the dirt.

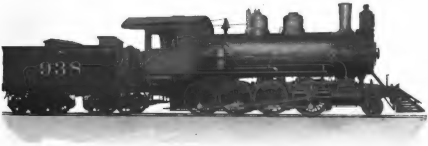
Mr. P. H. Peck, master mechanic, Chicago & Western Indiana Belt Railway, said that the best kind of oil to be used depends on the type of cup. A plunger-feed cup will feed a thick oil like valve oil more successfully than a needle-feed cup, as with a needle-feed cup the oil



BOILER FOR SIX-WHEEL COUPLED ENGINE ON THE MU VALLEY RAILWAY, INDIA. THESE ARE TO BE EQUIPPED WITH HORNISH MECHANICAL CLEANERS.







RECENT BALDWIN LOCOMOTIVES—DESCRIPTION NEXT PAGE.

must be thin enough to splash up around the needle.

Mr. R. H. Soule, Baldwin Locomotive Works, said that on the Norfolk & Western Railway they found that main pins gave more trouble on crooked track than on straighter divisions, so they concluded that it was because the pins got out of line a little when the engine was rocking around, and turned their attention to giving the main rod a little more freedom of motion at the crosshead end. This helped matters a great deal.

Mr. F. A. Delano, superintendent of motive power, Chicago, Burlington & Quincy Railroad, said that brasses should be bored out with a liner between the two halves of the brass, with the hole the thickness of the liner larger than the pin. When the brass was put on the pin this liner was left out. This left the opening in the brass a shade larger than the pin, with a good bearing at the sides, so that it soon got a good bearing all around.

Mr. F. M. Whyte, mechanical engineer, Chicago & Northwestern Railway, said that with old engines the pins might not run as cool as when new, because the cylinder had been bored out, and perhaps higher steam pressure carried, which would give more strain per inch of the bearing surface of the pin.

Others joined in the discussion, and while it was pretty well agreed that the best results were obtained by boring out new brasses a shade larger than the pin, very little was said about the proper method of fitting worn brasses when they were reduced, or the work needed on old pins when they got to the chronic hot stage. It takes as much skill to properly fit up an old brass which has been running cool as to put new ones in order.

Recent Baldwin Locomotives.

The April catalogue showing "Record of Recent Construction," which the Baldwin Locomotive Works have begun sending out regularly, is particularly attractive, containing some fine illustrations of the locomotive builder's art. There are fifteen illustrations of locomotives, eight of them being for foreign railways, which is significant of the kind of orders that have been coming into this country for the last few months. We notice that the Baldwin people have commenced giving dimensions of the locomotives in French as well as in English. The three locomotives shown are among the latest products of the Baldwin Locomotive Works.

The fine-looking ten-wheeler for the Paulista Railway of Brazil has cylinders 19 x 26 inches and driving wheels 68 inches diameter. The boiler is 62 inches diameter at smallest ring, carries a working pressure of 200 pounds to the square inch, and provides 1,967.80 square feet of heating surface. There are 268 2-inch tubes, 13 feet 2¾ inches long. The grate area is 23.9 square feet. The wheel-base is 22 feet 8 inches, 11 feet 8 inches of that being from center to center of driving wheels. The total weight of the engine is 134,381 pounds, of which 103,008 pounds rest on the drivers.

The second ten-wheel engine is also for the Paulista Railway, and the principal difference between it and the first is that the second one is compound. The cylinders are 14 and 24 x 26 inches. All the other dimensions are the same as those of the first engine.

The third engine on the page is a simple consolidation for the Atchison, Topeka & Santa Fé. The cylinders are 21 x 28 inches and the driving wheels 57 inches outside diameter. The boiler is straight and is 68 inches diameter and carries a working pressure of 180 pounds to the square inch. The heating surface is 1,905 square feet. There are 233 2-inch tubes, 13 feet 10 inches long. The driving-axle journals are 8 x 9 inches. The rigid wheel-base is 15 feet 2 inches, and the total wheel-base 23 feet 3 inches. The weight of the engine in working order is 157,000 pounds, of which 140,000 pounds are on the drivers.

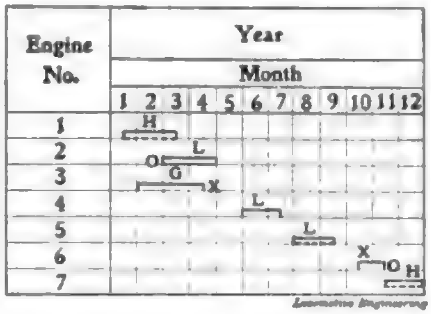
Doctor and Engineer.

The fastest locomotive on earth has been transferred to the Boston & Albany road by the daily papers, and is quoted as "a 126-tonner." This, of course, includes the tender, but as they want to use as big figures as possible they lump it all together.

The engine referred to is the "221" of the Boston & Albany, a Schenectady compound, which is doing remarkably good work, but which would blush with becoming modesty and immediately pop both safety valves to drown the flattery that is contained in the article mentioned. The engineer of the "221" has the distinction of being both an engineer and a physician, and as he does not leave Boston till 4 P. M., returning at 10 P. M., he has considerable time to devote to his patients. His name is H. F. Brackett and he lives in Brighton.

Locomotive Chart Used by Mr. N. Frey, Master Mechanic Chicago, Burlington & Northern Railway.

The sheets are full size, so that a number of years can be carried on one sheet, the years running across the page and down the column on the left-hand side, and there is sufficient space to take in all engines of one class or all engines of a particular division. This chart shows one at a glance what has been the history of



LOCOMOTIVE CHART.

any particular engine. Other things could be added to this same chart, as a person's fancy or ingenuity would suggest. In our small model we have confined ourselves to the standard nomenclature, which is as follows:

L represents light repairs, less than $1,000.
H represents heavy repairs, between $1,000 and $1,500.
G represents general repairs, more than $1,500.
Double lines represent new firebox supplied.
X represents flues changed.
O represents new tires.
Dotted lines represent new side sheets.

To explain the way the chart is used: By referring to diagram you will note that engine No. 1 has a heavy line and dotted line underneath and an *H* on top. This signifies that No. 1 was in the shop from the middle of January until the middle of March; that she was given repairs between $1,000 and $1,500, and also that new side sheets were applied. Engine No. 2 was in the shop two months, namely, March and April. The double line indicates that a new firebox was applied. The *L* signifies that she had light repairs, and the *O* new tires given. Engine No. 3 was in the shop two and a half months, namely, February, March and a half of April. She was given general repairs costing more than $1,500, and also the *X* indicates that flues were changed, and so on down the list. You can readily see by having a chart of this kind covering several years and adding on the current year, month by month as the reports come in, that valuable data are obtained, and are put in a shape where they are quickly get-at-able and appeal also to the eye.

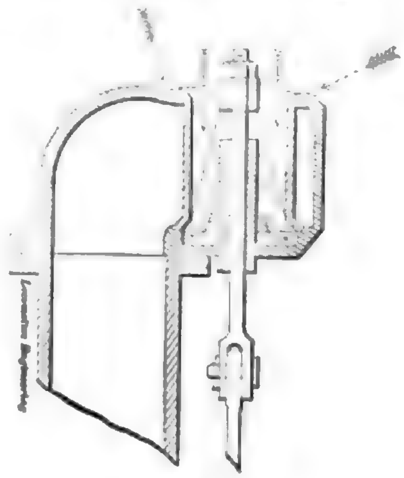
An Engineer's Nerve.

Daniel Smith, an engineer of one of the Reading fliers from Camden to Atlantic City, has about as much nerve as they ever put into men. It was shown without the excitement of a battlefield, and with nothing but his idea of duty to urge him on. The reverse lever flew backward, throwing him backward and making him unconscious. The fireman shut off, and revived him with cold water. Smith at once tried to reach the reverse lever, only to find his right arm was broken.

In spite of the entreaties of the fireman to stop and have it attended to, he ran the engine the remaining fifty miles with his left hand, and brought the train in on time. When he was being carried to the hospital he was cheered by both railroad men and passengers, who had learned of his pluck.

Throttle Valve.

The throttle valve shown in the annexed engraving is in use on the London & Northwestern Railway of England. The peculiarities of the valve will readily be



THROTTLE VALVE.

seen without any description. We are indebted to Mr. H. T. Bentley, of the Chicago & Northwestern, Belle Plain, Ia., for the drawing from which the engraving was made.

Mr. F. W. Hornish, of the Hornish Mechanical Boiler Cleaner Company, of Chicago, will be present at the convention, and will come provided with all necessary drawings and information to show the economical function of the device he has invented and perfected. The fact that the question of the removal of boiler impurities is urgent before the association and will be reported upon and discussed at the convention will make Mr. Hornish's presence valuable and timely.

Development of Powerful Express Locomotives on Great Northern Railroad of England.

BY PERCY JOHN COWAN.

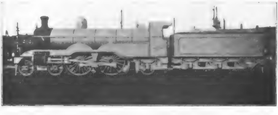
Some short time after the death of Mr. Patrick Stirling, at the beginning of 1896, one of the leading engineering journals drew attention to the fact that it was doubtful whether anyone would be found to succeed him at his post of locomotive superintendent of the Great Northern Railway, who would follow on the same lines as he had worked on. In this short article I hope to show your readers how this was borne out by subsequent events, by comparing things new and old—among the locomotives on the Great Northern Railway—a *comparison*, forsooth, which I think might well be called a *contrast*. Not a contrast in the forms of the cab, splashers, and safety valve cores, etc., which some would have us believe constituted radical changes in the design of an engine, but contrasts in types and dimensions of the essential parts of the machine.

True, many changes in the outward appearance of the engines have taken place, so much so, in fact, that were it not for the engines being still painted the same standard color (green) people might imagine that foreigners were running on our line. Among these changes which at once strike the eye are those mentioned above, but in reality they are but details.

With regard to the cab, it is a great improvement on the scanty shelter provided on engines of the old type. Slightly too square in its lines, perhaps, to be called graceful, it gives a good shelter to the men in all weathers, and is really a most serviceable improvement; and after all said and done, it is serviceable rather than graceful fittings that are required on an engine. It would take too long to compare all the new types Mr. Ivatt has brought out on this line, not that they are absolutely novel in England, but they are quite new types when compared with those in use on this line before Mr. Stirling died. These new engines, designed by Mr. H. A. Ivatt, M. Inst. C. E., have been built at the company's works at Doncaster under the able managership of Mr. D. E. Marsh.

To begin with, Mr. Stirling's celebrated 8-footers, with outside cylinders, having been outpaced by the growth of traffic and weight of trains, etc., it became necessary to provide locomotives capable of dealing with the extra work on the line. Mr. P. Stirling provided for this want as occasion arose, and while still adhering to his set types, built as time went on, heavier engines, until his last class was the 1,003-1,008 class. These engines cannot be said to have proved really successful, for there was considerable trouble in building them, and the enormous weight of twenty tons, as it was originally, on the driving wheels proved a sore strain on the permanent way. For this reason I have chosen "670" as a typical engine of the 8-foot singles, as this was in its day a most successful type of engine. Compare this with Mr. Ivatt's now famous engine No. 990 and see what a departure from standard English practice has been made, and with very satisfactory results, too.

No. 990 is a ten-wheeled engine of the Atlantic type, the first of the type yet built in England; but it is not American in design, as some would have us believe. As will be seen from the illustration given, it is a four-coupled bogie engine with trailing wheels, outside cylinders and return coupling rod. The main frames (slab frames) are 1⅛ inches in thickness, the trailing wheels with outside journals in a supplementary outside frame. This trailing end is to our eyes of a very neat design. The springs being outside, in case of failure, can be changed with very little trouble. The cylinders in "670" are fitted into the frames and bolted on. In No. 990 the cylinders are cast with a kind of half saddle and are fitted into the frames and bolted on and are also bolted together down the center line of the engine. A



GREAT NORTHERN OF ENGLAND LOCOMOTIVES.

second and marked difference to American practice is in the position of the valves. These are placed inside the frame so that the valves work in a vertical position. The valves are of brass and exhaust through the back, a great deal of the usual pressure on the valves being in this way relieved. The ports are only accessible from the front end of the steam chest through an opening measuring about 7 x 18 inches.

The boiler is a special feature in the engine. The barrel is 14 feet 8⅝ inches long, but the tube plates are only 13 feet apart; leave 1 foot 11¼ inches at the leading end of the barrel as extra smokebox room. Thus with the smokebox proper and this extra portion in the barrel of the boiler a total smokebox length of 5 feet 3 inches is obtained. The tubes, 2 inches diameter, are iron with copper ends at the firebox end and are ferruled at that end. At the smokebox end they are merely drifted by hand. The total heating surface of "990" is 1,442 square feet, while of "670" it is only 1,045 square feet, a gain of nearly 400 square feet. In the grate we find a gain of 9.05 square feet from 17.75 square feet in the old to 26.8 square feet in the new. The boiler center is also 7¾ inches higher in "990" than in "670," being now 7 feet 11 inches above the rail level.

Turning next to Mr. Stirling's express engines, with 7-foot 6-inch single drivers and inside cylinders (about the cheapest engines on the line on the coal bill), Mr. Ivatt has lately completed at Doncaster the 7-foot 6-inch single express, No. 266, shown in the accompanying photograph. A bogie replaces the leading pair of wheels; the trailing wheels again have the new design of frame, etc., and outside springs. Now, in the engines of the "239" type, if a leading spring broke, it was pretty bad, as they are very awkward to get at, inside the frames on the top of the boxes; but if a trailing spring breaks, it is even worse. The tender has to be uncoupled, and one of the horn blocks let down and the spring got up, or else the engine must be lifted and the trailing wheels taken out. The first method is usually adopted as being the quickest, but not perhaps the most convenient for the men, although one horn block has to be removed—a thing that should really never be done after they are adjusted in the erecting shops. The boiler of "266" is a great improvement on "239." The new boiler has a heating surface of 1,268 square feet, compared with 1,109 square feet in "239," and the grate area is increased from 18.4 square feet to 23 square feet in "266." This engine, No. 266, has an uncommonly high boiler center for English practice. It is placed as much as 8 feet 3 inches above the rail level, while the old 7-foot 6-inch singles had their boiler center only 7 feet 6 inches above the rail.

Another very notable class introduced by Mr. Ivatt is that of which No. 1,329 is an example. Mr. Stirling's class of four-coupled 6-foot 6-inch engines is shown in No. 898. What a difference in the appearance of these two engines! No 898, again, has leading wheels in outside boxes, springs on the top, inside; a most awkward design to work at in sheds—all sacrificed to neatness. The new engines are extremely neat, but their neatness is of a different nature. They have four-wheeled bogies, and the outside frames are altogether dispensed with. It was remarked to me a short time ago that these engines had quite an American look about them, and on my asking what gave them it, I was referred to the new style of footplate which is now raised at the coupled wheels, a rather slender foundation on which to base such an assumption; for if "1329" were for a moment compared with any American engine, what contrasts should we not see?

GREAT NORTHERN OF ENGLAND LOCOMOTIVES.

The standard bogies have a wheel-base of 6 feet 3 inches. The center casting, which is bolted on to the cylinders, drops into a large cast-iron cup. This cup is suspended by swing links to the bogie proper, and is allowed a lateral swing and performs the same work as the cups usually controlled by springs in other designs. The journals are 5½ inches in diameter and 9 inches long, and the weight on each box is supported by two helical, or in some of the newer engines on two spiral, springs, in all, therefore, eight springs to each bogie.

The little ends (crossheads) are plain eyes with brass bushes driven in, instead of the straps and split brasses, etc., of the old ones; and of necessity with this change, the design of the crossheads has been greatly altered. The old crosshead was made up of crosshead and two slipper blocks. The new ones are all in one, but the blocks are fitted with detachable shoes, and the gudgeon (wrist) pin can be drawn out. The long cast-iron chimneys are replaced by ones made up of three pieces, the barrel of wrought iron and the flanges for top and bottom of cast iron. These chimneys being rather short on account of the high boiler centers, an extension piece with a bell mouth is fitted to them inside the smoke-box. In the cab a great change has taken place. On the boiler front are the injector steam and clock (chuck) valve mountings, two gage glasses, the regulator handle and stuffing-box and the large ejector for the vacuum brake, while above the regulator stuffing-box stands a column to which is attached the whistle and cocks, etc., for the steam gage, heating apparatus, sight-feed lubricator and steam sand gear. In this way steam for five different mountings is provided through one hole in the boiler plating. Screw-reversing gear takes the place of the lever. The engines are coupled by means of a central coupling to the tenders. The engines are fitted with exhaust injectors on Davies & Metcalfe's patent principle. The tractive effort for each pound of mean effective pressure in the cylinders does not differ much in the new classes from the old, except in the case of "990." But as the boiler pressure is considerably higher now, the total tractive effort is much greater in the new than in the old classes, and in "990" this difference is very considerable.

Doncaster, England.

Mr. Cowan sent us a very elaborate table giving particulars about the engines, from which we abstract the following facts. Engines 670, 239 and 898 were built

in 1896. Engines 990, 266 and 1,329 were built in 1898, and may be regarded as showing the latest ideas of Mr. Ivatt, the designer. A study of the annexed table and of the illustrations will enable people interested to make intelligent comparison between British and American practice, if they are familiar with the dimensions of recent American locomotives.

ENGINE NUMBER	990	870	266	239	1329	898
Cylinder's dimensions	18¾ x 24 in.	18 x 28 in.	17 x 26 in.	18½ x 26 in.	17½ x 26 in.	17½ x 26 in.
Steam Ports	16 x 1½ in.	16 x 1⅜ in.	16 x 1⅜ in.	16 x 1⅜ in.	14 x 1½ in.	14 x 1⅜ in.
Diameter of Driving Wheels	79½ in.	97⅜ in.	91⅜ in.	91½ in.	79⅝ in.	79⅝ in.
Boiler diameter at S. ring	56 in.	49 in.	53 in.	50 in.	56 in.	45⅝ in.
Boiler length	14 ft. 8½ in.	11 ft. 5 in.	11 ft. 4 in.	11 ft. 5 in.	10 ft. 1 in.	10 ft. 4 in.
Heating surface	1442 sq. ft.	1045 sq. ft.	1268 sq. ft.	1109.7 sq. ft.	1249.8 sq. ft.	1105.3 sq. ft.
Grate area	26.8 sq. ft.	17.75 sq. ft.	23 sq. ft.	18.4 sq. ft.	20.8 sq. ft.	16.25 sq. ft.
Boiler pressure	175 lbs.	160 lbs.	170 lbs.	160 lbs.	170 lbs.	160 lbs.
Weight on drivers	71344 lbs.	38080 lbs.	40320 lbs.	38976 lbs.	69212 lbs.	51520 lbs.
Total weight of engine	129920 lbs.	101136 lbs.	106400 lbs.	90956 lbs.	105952 lbs.	73136 lbs.
Wheel base	26 ft. 4 in.	22 ft. 11 in.	23 ft.	18 ft. 1 in.	22 ft.	17 ft. 11 in.
Rigid base	14 ft. 10 in.	8 ft. 8 in.	9 ft. 10 in.	18 ft. 1 in.	9 ft.	17 ft. 11 in.

Chicago International Correspondence School.

A branch office of the International Correspondence School of Scranton, Pa., has been opened in Chicago at 202 Monadnock Block. The offices are fitted up in good shape for attending to this work. There is a force of seventy persons employed, which will give an idea of the amount of business done. About 4,000 students in the city of Chicago alone report to this office.

Mr. Louis H. Savers is the manager. The headquarters of the railroad department are also located here, in charge of Mr. W. N. Mitchell, manager. Their business is increasing month by month at a rapid rate.

Mr. W. B. Huskey, who was lately connected with the Correspondence School of Locomotive Engineers and Firemen, at 335 Dearborn street, Chicago, is now superintendent of this department, which has three cars out on the different railroads in the country, and more cars are building to supply the demand.

Ruberoid Cab Roofing.

A special grade of ruberoid, known as P. & B., has been put on the market by the Standard Paint Company, 81 John street, New York, and it is meeting with decided favor. This material has as a base the best of wool and hair felt (not the cheap kind that is ordinarily used in tar roofing), which is thoroughly saturated with the company's water and acid-proof composition, which preserves the felt and makes it practically indestructible. The tough skin-like surface put on in the process of manufacture thoroughly protects this saturation, keeps the material pliable and elastic for years. It positively cannot dry out and become brittle, will stand any amount of walking on, is not easily cut, is strong, very durable, odorless and clean to handle. It is absolutely unaffected by the action of locomotive fumes, steam and gases. We readily appreciate the vast superiority of this material over tin for locomotive cabs. Not only does it cost half as much, but is easy and more economical to apply, needs less attention when once put on, and can never rust or corrode as will a tin roof. Since the company have been pushing this material they have been deluged with inquiries from all parts of the country. Every railroad man who has seen it seems to be pleased with the goods.

The same company are also manufacturers of the well-known ruberoid roofing for roundhouses, train sheds, etc., as well as P. & B. ruberoid car roofing, waterproof insulating papers for refrigerator cars, etc.

ERECTING SHOP, GREAT NORTHERN OF ENGLAND RAILWAY.

Twelve Business Maxims.

The president of the London Chamber of Commerce gives twelve maxims which he has tested through years of business experience, and which he recommends as tending to insure success:

1. Have a definite aim.
2. Go straight for it.
3. Master all details.
4. Always know more than you are expected to know.
5. Remember that difficulties are only made to overcome.
6. Treat failures as stepping-stones to further effort.
7. Never put your hand out farther than you can draw it back.
8. At times be bold; always prudent.
9. The minority often beats the majority in the end.
10. Make good use of other men's brains.
11. Listen well; answer cautiously; decide promptly.
12. Persevere, by all means in your power, "a sound mind in a sound body."

The Clayton Air-Compressor Works, Havemeyer Building, New York, have issued a new illustrated catalogue, which they call No. 10. This catalogue is one of the most complete works of its kind and embodies the very latest and highest types of air-compressing machinery. It contains illustrations and lists of sizes of the standard patterns, also illustrative descriptions of the Clayton type of compressor. Among the other contents of this catalogue will be found valuable data and tables of compressed air transmission and capacity lost by air compressors in operation at various altitudes. Air receivers, vacuum pumps, carbonic acid gas and high-pressure compressors are all fully described.

The Brotherhood of Railroad Trainmen is in the best condition it has ever been, with a membership of 35,000 and nearly $300,000 in its treasury. The order has paid nearly $5,000,000 in beneficiary claims. The first convention was held in Oneonta, with an attendance of thirty-five officers and delegates. At the convention to be held in New Orleans next week there will be over 600 delegates and grand officers. The representative of Moses Taylor Lodge, of Scranton, is J. H. McCann.

When the short-lived bearing-metal combination swallowed the Brady Metal Company, Mr. Dan. M. Brady lost no time in forming The Brady Brass Company, which is now ready for business.

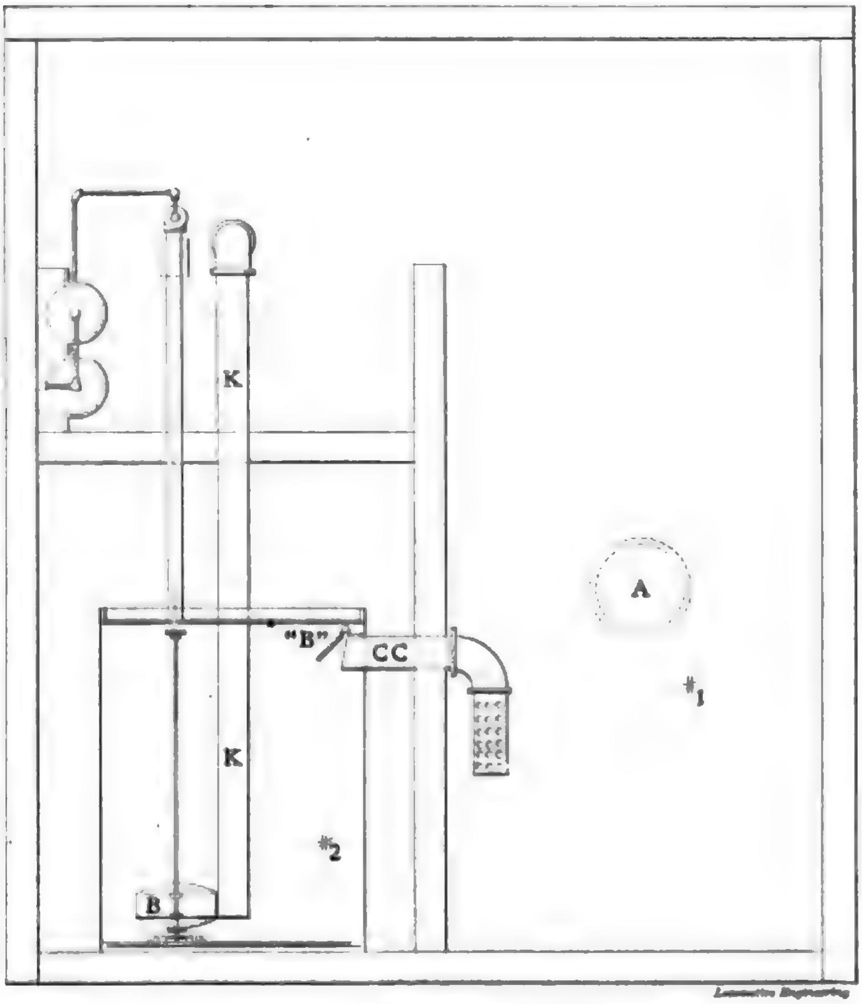


FIG. 1.

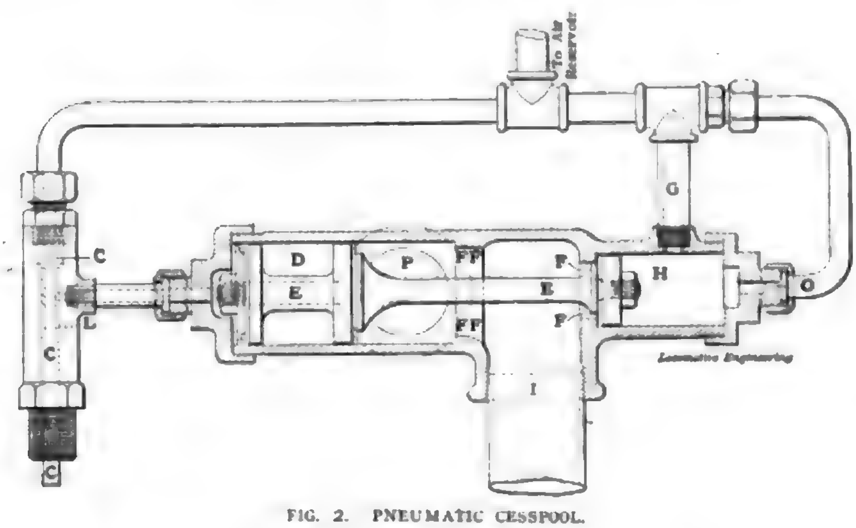


FIG. 2. PNEUMATIC CESSPOOL.

Pneumatic Cesspool.

The pits and roundhouse sewer of the Chicago, Burlington & Northern roundhouse, situated at LaCrosse, Wis., are several feet below the level of the main drain, and were on this account a serious source of trouble until Mr. N. Frey, the master mechanic, provided an automatic pneumatic cesspool, shown by Figs. 1 and 2.

The cesspool is 12 x 12 feet inside and 15 feet deep, divided into two compartments, one to receive the water, the other has the pneumatic tank placed in it, and its action is made clear by the following description:

Sewer pipe *A* discharges into department 1. The water passes through pipe *C C* into pneumatic tank 2. While filling, float *B*, guided by an iron frame, rises to the top and lifts the frame, which also forms the guide to the float. This frame or guide is connected to a balanced lever which actuates valve *C*, Fig. 2, and admits air into cylinder *D*, forcing piston valve *E* forward, closing communication at *F F* to atmosphere and opening communication at *F* to tank admitting air from pipe *G* to pass through cylinder *H* and pipe *I* into tank 2, Fig. 1, closing up gate valve *B* and forcing the water out through discharge pipe K. Float *B* will now lower as the water discharges and striking the bottom part of frame will close valve *C*, allowing the air in cylinder *D*, Fig. 2, to exhaust through small hole *L* to the atmosphere. Cylinder *H*, which is always charged with reservoir pressure through pipe *O*, will force piston *E* back to place, closing communication at *F* from air pipe *G* and opening communication at *F F* to allow the air to exhaust through opening *P* to the atmosphere. Two small air reservoirs are shown at the back of the valve which are directly connected to the compressed-air main of the shop. This device works automatically as long as there is any water to operate it, and has proven a success.

Some of the railroad companies have issued orders discharging the lady employés and replacing them with men. This is an undue reflection upon the business qualities of the fair sex. Of course, there are very few lady clerks or employés of the transportation companies who are working zealously for the presidency or even for the general managership, but there are many of them who are energetic and enterprising—and withal, invaluable assistants in their respective capacities. A bright, charming young woman by the name of Miss Sarah McAleiter, who holds down the agency for the Port Arthur Route at Ewing, Mo., has not only demonstrated her ability as a competent railway employé, but also as a heroine of unusual fortitude. One night a few weeks since she heard burglars in the depot, when she seized a gun with five big loads in it and started for the scene. At the point of her revolver they were forced to evacuate. Five ineffectual shots were fired at their retreating forms, but she saved the cash box of the railway company.—*Railway Journal.*

We learn from the Nicholson File Company that the "File Filosophy," notice of which was made in these columns upon its publication two months ago, has proved so popular that a second and much increased edition is rendered necessary. The little book has been sent to thousands of machinists and file users throughout this country and abroad. Treating as it does of files and how to use them, it proves invaluable to anyone interested in that class of tools. All those who have not secured a copy would do well to get one. They may be had free upon application to the company's head office in Providence, R. I. Mention that the notice was seen in Locomotive Engineering.

PERSONAL.

Mr. C. F. Winn has been appointed master mechanic of the Chesapeake Beach Railway, with headquarters at Washington, D. C.

Mr. B. Pratt has been appointed superintendent of air brakes at the Duluth & Iron Range shops, Two Harbors, Minn., vice Mr. Hall.

Mr. F. J. Pease has been appointed master mechanic of the Milwaukee, Benton Harbor & Columbus, with headquarters at Benton Harbor, Mich.

Mr. H. B. Pierce, assistant trainmaster of the Pittsburg & Lake Erie, has been appointed trainmaster, with headquarters at McKees Rocks, Pa.

Mr. H. E. Van Housen has been appointed assistant superintendent of the Union Pacific at Green River, Wyo., vice Mr. J. W. Hay, transferred.

Mr. James Barrington has been appointed traveling fireman on the Wyoming division of the Lehigh Valley, with headquarters at White Haven, Pa.

Mr. G. C. Gilroy has been appointed trainmaster of the Mahoning division of the Lehigh Valley at Hazleton, Pa., in place of Mr. G. W. Brill, resigned.

Mr. W. S. Battle has been appointed general superintendent of the Virginia & Southwestern, with office at Bristol, Va., in place of Mr. W. B. Emmert.

Mr. E. E. Styner has been appointed general superintendent of the San Luis division of the Mexican Central, with headquarters at the city of Mexico.

Mr. M. S. Monroe has been appointed locomotive foreman of the Delaware, Lackawanna & Western at Hoboken, N. J., vice Mr. Geo. H. Sticher, resigned.

Mr. A. Verhelle has been appointed acting master mechanic of the New York, Texas & Mexican at Victoria, Texas, in place of Mr. R. L. Herbert, resigned.

Mr. G. C. Jones, division superintendent of the Grand Trunk at St. Thomas, Ont., has been transferred to Toronto, Ont., vice Mr. E. H. Fitzhugh, resigned.

Mr. E. A. Donkin has been appointed assistant superintendent of the Cascade division of the Great Northern at Everett, Wash., vice Mr. F. J. Hawn, transferred.

Mr. P. R. Morris has been appointed general foreman of the car department of the Chicago, Milwaukee & St. Paul at Chicago, Ill., vice Mr. W. O. Davis, transferred.

Mr. J. W. Hay, trainmaster of the Union Pacific at Green Bay, Wyo., has been appointed assistant superintendent at Laramie, Wyo., vice Mr. C. Curloss, resigned.

Mr. W. L. Breckenridge has been appointed chief engineer of the Chicago, Burlington & Quincy, with headquarters at Chicago, Ill., vice Mr. E. J. Blake, promoted.

Mr. G. F. Hawks has been appointed superintendent of the San Luis division of the Mexican Central at San Luis Potosi, Mex., in place of Mr. E. E. Styner, promoted.

Mr. Edw. James has succeeded Mr. John Vogt as general foreman at Wilkesbarre shops on Lehigh Valley Railroad. He was formerly roundhouse foreman at Lehighton.

Mr. James H. Clark has been appointed assistant superintendent of floating equipment in charge of all floating equipment of the Baltimore & Ohio Railroad in New York harbor.

Mr. E. H. Fitzhugh, division superintendent of the Grand Trunk at Toronto, Ont., has been elected vice-president and general manager of the reorganized Central Vermont.

Mr. I. H. Burgoon has been appointed general superintendent and general passenger agent of the St. Louis, Caruthersville & Memphis, with headquarters at Caruthersville, Mo.

Mr. H. F. Lowther has been appointed chief clerk of the motive-power and machinery department of the Delaware, Lackawanna & Western, with headquarters at Scranton, Pa.

Mr. F. W. Williams has been appointed general foreman of the machinery department of the Scranton shops of the Delaware, Lackawanna & Western. This is a newly created position.

Mr. A. G. Palmer has resigned as superintendent of the Beech Creek to accept the position of superintendent of the Pennsylvania division of the New York Central & Hudson River.

Mr. A. B. Quimby has been appointed general foreman of the Chicago & Northwestern shops at Winona, Minn. He has been foreman of the Tracy shops of this road since November, 1897.

Mr. J. T. C. Davis has been appointed assistant superintendent of the Nashville and Chattanooga divisions of the Nashville, Chattanooga & St. Louis, with headquarters at Nashville, Tenn.

Mr. R. F. Kilpatrick, general foreman of the Chicago, Rock Island & Pacific at Horton, Kan., has resigned to accept a position with the motive power department of the Delaware, Lackawanna & Western.

Mr. W. J. Wilcox has been appointed division master mechanic of the Santa Fé Pacific Railroad at Winslow, A. T., vice Mr. T. F. Underwood, resigned. Mr. Wilcox was formerly located at Blacksburg, S. C.

Mr. James Slavin has been appointed master mechanic of the Spokane Falls & Northern, Nelson & Fort Sheppard and Red Mountain railways, with headquarters at Spokane, Wash, vice Mr. C. H. Prescott, resigned.

Mr. C. D. Pettis has resigned as assistant to Mr. John Medway, master car builder of Swift & Co., to become general foreman of the car department of the Illinois Central, succeeding Mr. A. L. Kendall, resigned.

Mr. George W. West, superintendent of motive power of the New York, Ontario & Western, has been appointed American Reporter on Brakes and Couplings for the International Railway Congress, which meets at Paris next year.

Mr. A. L. Kendall, general foreman of the car department of the Illinois Central, has been appointed master car builder of the Lake Shore & Michigan Southern at the Englewood shops, Chicago, in place of Mr. T. Fildes, resigned.

Mr. L. J. Ferritor, assistant superintendent of the middle division of the Grand Trunk at London, Ont., has been transferred to the Southern division, with headquarters at St. Thomas, Ont., in place of Mr. G. C. Jones, transferred.

Mr. H. S. Reardon, superintendent of the Detroit, Toledo & Milwaukee, has been appointed general manager of the Omaha, Kansas City & Eastern and Omaha & St. Louis, with office at Quincy, Ill., succeeding Mr. Robert Gillham, resigned.

Mr. Geo. S. Hodgins, whose name is familiar to our readers, has resigned the position of locomotive inspector on the Canadian Pacific to take that of mechanical engineer of the Canadian Locomotive & Engine Company, Limited, of Kingston, Ont.

Mr. R. L. Herbert, master mechanic of the New York, Texas & Mexican at Victoria, Texas, has resigned to accept the position of master mechanic of the Galveston, Harrisburg & San Antonio at El Paso, Texas, succeeding O. De Young, deceased.

Mr. Sidney H. Wheelhouse, formerly of the M. M. Buck Manufacturing Company, St. Louis, Mo., is now connected with the Chicago Pneumatic Tool Company as Southwestern agent, with salesroom and office at 409 North Fourth street, St. Louis.

Mr. J. V. A. Trumbull, superintendent of the Valley division of the New York, New Haven & Hartford, has been transferred to the Stonington division, with headquarters at Providence, R. I., vice Mr. J. B. Gardiner, resigned on account of ill health.

Mr. George Whaley, vice-president and general manager of the Panama Railroad, has been appointed first vice-president, with office at Paris, France. Mr. E. A. Drake has been made second vice-president and retains the office of secretary. Mr. Charles Paine has been appointed general manager, with office at 29 Broadway, New York.

Mr. James Metcalfe, of Manchester, England, is visiting this country with a view of introducing the Davis & Metcalfe locomotive exhaust injector. That injec-

tor is practically a feed-water heater, as it transfers a portion of the exhaust steam to the feed water.

The officers of the Western Railway Club for the coming year are: President, H. G. Hetzler; First Vice-President, A. E. Manchester; Second Vice-President, W. F. M. Goss; Treasurer, Peter H. Peck; Directors, R. D. Smith, B. Haskell; Library Trustees, F. W. Sargeant, Wm. Forsythe, F. A. Delano.

Mr. F. W. Brazier, who has been some time assistant superintendent of machinery of the Illinois Central at Chicago, Ill., has resigned to accept the position of assistant superintendent of rolling stock of the New York Central, with headquarters at Grand Central Station, New York. He succeeds Mr. S. A. Crone, resigned.

Mr. W. W. Wheatly, who is well known to railroad men through his connection with the New York Railroad Club, as secretary, has been appointed assistant general superintendent of all the lines owned or controlled by the Brooklyn Rapid Transit Company. He was heretofore division superintendent.

The following traveling engineers have been appointed by Mr. W. C. Hayes, locomotive superintendent of the Baltimore & Ohio Railroad: Mr. W. J. Duffy, Parkersburg & Wheeling division; Mr. W. B. Blackwell, Second division; Mr. M. Carey, Pittsburgh to Cumberland and Wheeling; Mr. D. E. Fisher, Third division.

The American Brake Shoe Company, of Chicago, will be represented at the convention by Mr. Fitz-William Sargent, and the Sargent Company by Messrs. W. D. Sargent, J. W. Gardner and G. H. Sargent. Their headquarters will be in the Palm Garden of the Hotel Chamberlain, and they extend a cordial invitation to all their friends to meet them there.

Mr. William Forsyth, superintendent of motive power of the Northern Pacific, has resigned on account of ill health, and the duties of that office will be assumed by Mr. Alfred Lovell, assistant superintendent of motive power. Mr. Forsyth was for many years mechanical engineer of the Chicago, Burlington & Quincy, and left that position last September to go with the Northern Pacific.

Mr. J. S. Chambers, master mechanic of the Lehigh Valley for about six months, has resigned to take the position of master mechanic of the Central of New Jersey at Elizabethport, N. J., in place of Mr. N. E. Sprowl. Mr. Chambers was formerly division master mechanic of the Illinois Central, and went with the West Virginia Central & Pittsburg last October as superintendent of motive power.

General Superintendent Graham, of the Baltimore & Ohio lines west of the Ohio River, has issued a circular, dated May 1st, which again extends the authority of J. H. Glover, superintendent of the Ohio and "land divisions over the Lake Erie and Straitsville divisions. G. A. Richardson, assistant superintendent, will have charge of the Ohio and Midland divisions, and all reports and communications in regard to lake traffic will be sent to him.

Mr. P. J. Cowan, who is an assistant to Mr. H. A. Ivatt, locomotive superintendent of the Great Northern of England, is enjoying a holiday visit to this country. He is now visiting relatives in California. Mr. Cowan is an occasional contributor to LOCOMOTIVE ENGINEERING, and has this month an illustrated article on "Development of Powerful Express Locomotives on the Great Northern."

When P. M. Arthur was an engineer on the New York Central he first became popular with the men owing to the courageous manner in which he used to appeal to the officials for the adjustment of grievances. At that time he became popularly known among the men as "the peach." Now-a-days he is merely "the Old Man," but there is lots of fondness and respect covered up in that familiar expression.

The appointment of W. C. Hayes as locomotive superintendent of the Baltimore & Ohio Railroad will be followed by a distinct change in the plan of overseeing locomotives in service. The positions of "supervisors of engines and trains" have been abolished and traveling engineers substituted, who will report to the new official at Mt. Clare, Baltimore. The road has been divided into the following subdivisions and a traveling engineer appointed for each: Philadelphia to Washington, Baltimore to Brunswick, Brunswick to Cumberland, Cumberland to Grafton, Grafton to Benwood and Parkersburg, Pittsburgh to Cumberland and Wheeling, Wheeling to Sandusky and branches, Chicago to Akron. The plan is expected to produce economical results with an improved service.

Some important changes have been made in the maintenance of way department of the Baltimore & Ohio lines east of the Ohio River by Assistant General Manager Willard. There will hereafter be four division engineers instead of six, with territory and headquarters as follows: B. T. Fendall, all lines between Philadelphia and Brunswick, Md., with headquarters at Baltimore; G. B. Owen, the main line and branches between Brunswick, Md., and Grafton, W. Va., including Brunswick yard, with headquarters at Cumberland, Md.; J. F. Cassell, the main line from Parkersburg to Wheeling, including both terminals and the Belington branch, with headquarters at Grafton, W. Va.; C. T. Manning, the main line and branches from Wheeling to Cumberland by way of Pittsburgh, with headquarters at Pittsburgh.

The headquarters of the *Street Railway Journal* have been removed from 36 Cortlandt street to 120 Liberty street, New York.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(58) Fireman, Chicago, writes:

We have been talking combustion of coal a good deal lately, and I wish to ask how much air must mix with the fuel gases to burn each pound of coal? A.—About 12 pounds, but as the stream of air passes through the mass of fire about 18 to 24 pounds of air must be provided to ensure a liberal supply.

(59) Apprentice, New Haven, Conn., asks:

What is meant by the radius of a link? A.—Examination of a link will show that it is a segment of a circle. Its radius is the distance from the center of a circle to the periphery of the circle which coincides with the curve of the link. Send for Sinclair's new book on "Locomotive Engine Running," and study the chapter on valve motion.

(60) R. M. B., Providence, R. I., writes:

1. Has ever any attempt been made to produce a coal-feeding device for locomotive fireboxes, such as the automatic stoker for stationary boilers? A.—1. We believe that several attempts have been made to adapt mechanical stokers for locomotive fireboxes. 2. Would a successful invention of this kind be valuable? A.—We believe it would be valuable.

(61) M. C. S., Chicago, writes:

1. If I were to anneal the tires of passenger wheels, in order to remove the hard spots, instead of chipping them, would the tire be likely to come off the wheel of its own weight? A.—1. No. 2. Are the tires tempered? A.—2. No. 3. How would the heat affect paper wheels? A.—3. The heat would be liable to destroy paper wheels. 4. Do you think it would be practicable to do this? A.—4. We do not think the plan is practicable.

(62) Shop Foreman, Detroit, writes:

Our men have lately taken to discussing problems of engineering, and one has made the statement that he read in LOCOMOTIVE ENGINEERING that driving wheels with tires 4 inches thick increased what they call the hammer blow, and are much harder on the track than wheels with tires 3 inches thick. My experience with line-shaft pulleys makes me doubt this. Is it really so? A.—No. Its tendency will be to soften the blow imparted to the rail by the unbalanced parts.

(63) R. W., Napin, Pa., first gives particulars of a side rod breaking when the engine was running 12 miles per hour with the caboose only. Before that the engine had been running 35 miles per hour, and the track was good. The questions are asked: 1. What caused the rod to break at the slowest speed? The temperature was 30 degrees below zero. A.—

1. This is a question that could only be answered after a careful inspection and full knowledge of all the circumstances attending the breakage. 2. What will cause front part of left driving box to crack on 17 x 24 engine, all wedges being properly adjusted? A.—2. The previous answer applies to this question also.

(64) R. C., Buffalo, N. Y., writes:

A friend of mine has invented a brake-shoe arrangement which does not rub upon the wheel, but upon the rail, and he argues that its use will greatly reduce the wear of tires, stop the breakage of cast-iron wheels from overheating on long grades, and do more efficient retarding of the train than the brake applied to the wheels. Would you advise me to go to the expense of paying for the patent when a half interest is offered for that expenditure? A.—No. Rail brakes have been tried hundreds of times and no inventor could obtain a patent on such a device nowadays. All the arguments in its favor are fallacies.

(65) C. A. B., Springfield, Mass., writes:

Your article on "Weight of Steam and Water" induced me to turn over the leaves of a book on steam, and on reading it over I find the statement made that the heat necessary to generate steam from water is 1,178 degrees, instead of 212 degrees as I have been accustomed to suppose it was. The book says that when water reaches 212 degrees, the boiling point, 966 degrees more must be added to evaporate the pound of water, and that 966 degrees is called the latent heat in the steam. Now I want to know how that can be proved. A.—This is demonstrated by evaporating a definite quantity of water into steam, then passing it into a condenser and noting how much heat it will impart to a given weight of water.

(66) W. M., Philadelphia, Pa., writes:

I am in a position to hear a great deal said about oil and lubricants, and I am constantly hearing reference made to certain degrees of gravity of oils. I have looked up several encyclopedias to find out what this gravity means, but have never obtained a clear explanation. Can you enlighten me? A.—The specific gravity of substances is generally calculated in their relation to the weight of water. The gravity or weight of oil is reckoned according to what is called the Baumé scale. In this, water is put down as 1, and as all oils are lighter than this, their specific gravity is a fractional part of 1. A common case is oil of 32 degrees gravity, which has a specific gravity of .8641, as compared with water. The system is very confusing. Instead of 32 degrees gravity that oil ought to be known as 86 degrees gravity, which would nearly agree with its relative weight with water.

(67) Learner, Topeka, Kan., writes:

Why is it that an engine with small driving wheels will start a heavier train than an engine with large driving wheels? I know there is something in it about leverages, but I never could understand leverages, and so I should like a practical answer. A.—If you ride a bicycle we can explain in a way that will appeal to you. Say you ride a wheel with 84 gear, which means a wheel equal to one 7 feet diameter, and your friend rides one which is 72 gear. In climbing a hill with your 7-foot wheel you are able to exert your physical effort once through 23 feet, and your friend with his 72-gear wheel can put his effort in once every 20 feet advanced. This enables the small-geared wheel to use the power to better advantage than that of the high gear. In like manner the engine with small driving wheels can pull a heavier load than one with large wheels, because it uses the power of the cylinders oftener in a given unit of time.

To Tell Steel from Iron.

In selecting scrap iron for the shingling furnace it is important to exclude pieces of steel, as the presence of that material causes a bad forging. It is sometimes very difficult for workmen to distinguish between iron and steel, but there is a certain test that never fails if intelligently carried out. In case of doubt put a drop of nitric acid on the metal, allow it to act for one minute then wash it off with water. If the piece is iron a grayish-white mark will be left; if the metal is steel the spot will be black.

In a recent issue of Locomotive Engineering we mentioned that the price of the *Locomotive Magazine*, published by F. Moore, of South place, Finsbury, London, England, was six shillings a year. Mr. Moore writes saying that the common form of the magazine costs only 60 cents, but that a superior edition is published, which costs $1.75 a year. The magazine for May is a particularly attractive number.

Some time in April the announcement was published that the leading bearing metal manufacturers had formed a trust and intended to control the business of making bearings. It turned out, however, that the leading makers of bearings did not bite the bait offered, among these being the Ajax Metal Company, of Philadelphia. When invited to enter the trust, the level-headed Ajax man intimated that he did not propose to have anything to do with combinations, good, bad or indifferent, and that his company intended to continue in their regular business just as they had done in the past, using due diligence in giving their patrons a superior metal at the lowest possible price. This action of the biggest concern in the business must have had a depressing effect upon the combine, for it is already fallen to pieces.

An Excursion in 1853.

It is rather interesting to read in an old railway paper of 1853 that "on the 19th day of August, 1853, the New Jersey Locomotive & Machine Company took their employés on an excursion to visit the fair being held in Crystal Palace, New York. They were drawn from Paterson to Jersey City by the locomotive R. L. Colt, which was built by this company for the Erie Railroad in eighteen days."

We judge from other parts of the description that a good supper on the return to Paterson wound up the very enjoyable outing.

Through the courtesy of the Wabash Railroad, the St. Louis Railway Club, to the number of two hundred, made a trip to the University of Illinois May 12th. The party left St. Louis at 9 A. M. on the Continental Limited, and arrived at the University of Illinois at 1 P. M. After luncheon a tour was made of the buildings occupied by the College of Engineering, including the hydraulic and materials testing laboratory, the forge shop, foundry and machine shop, the electrical engineering laboratory, the mechanical engineering laboratory, the central heating plant and the main Engineering Hall, as well as the handsome new Library Building. Time did not permit an inspection of the buildings devoted to the other colleges of the University. A brief session of the Club was held at which the relation between education and railroad service was discussed. The visitors left Champaign at 5 P. M., supper being served on the train. A quick run was made, the 161 miles from Sidney to St. Louis being run in 2 hours 35 minutes.

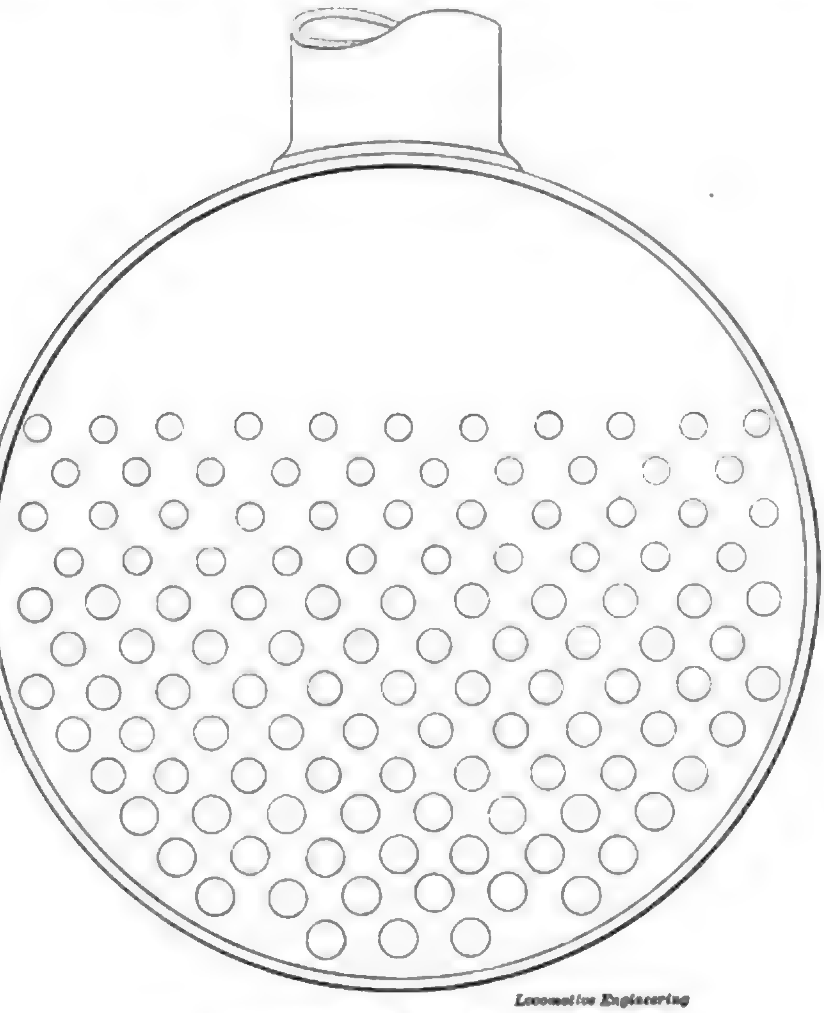
A curious incident happened in the New York Central freight house in New York City a few years ago which illustrates the necessity for correct spelling. The contents of a certain car was entered as a "roan horse." On looking at the bill one of the freight handlers boldly broke the seal, pushed open the door and entered, but he tumbled out in great trepidation, closing the door with a crash. The "roan horse" was a rhinoceros consigned to a scientific institution. The freight agent telephoned to the Barnum & Bailey circus people to send a van to cart away the animal, and when it arrived and the car door was opened again they found that the animal was stuffed.

The Chicago Pneumatic Tool Company have purchased the patents formerly owned by the Consolidated Pneumatic Tool Company, now defunct. These patents include all the Keller and Wolstencroft types of tool construction, and in addition several new applications which have not yet been taken out. These patents originally cost the Consolidated Pneumatic Tool Company about $40,000.

Roundhouse Chat—Spacing Flues.

BY R. E. MARKS.

"Say, Uncle Billy, have you got any cure-all for a broken back—I've been boring flues on that old '17,' and I'm about dead. Pretty fair steamer she is, but the darned old flues are so small that they choke up. Wish they only had one flue, and that was about 2 feet across—wouldn't stop up, maybe," and Jack Wilson sat down in the oil-house to rest his weary back. He was a kind of a kicker, but was rather an observing chap, after all; and after he had got breath from his long speech, he broke out with: "Say, Uncle Billy, why do the bottom flues stop up so much worse than the upper ones; is it because the exhaust nozzles stand in the way and break the blast?"



DIFFERENT SIZED TUBES IN BOILER.

"Not altogether, Jack," Billy replied. It was an "off" time of day, and he had time to talk a little. "The heat from the fire seems to rise up and go mostly through the upper flues, while the fine stuff kinder gets dragged along into the lower flues and chokes 'em up, because there isn't so much blast there.

"This has been proved many times; once by fastening a pine stick in the front end, ahead of the flues, and running the engine a trip. The top of the stick was charred all to pieces, and this kept growing fainter down the stick; finally hardly scorching it at the bottom."

"Why not put in bigger tubes all over the boiler, then, so they'll be too big to stop up," and he rubbed his back again.

"Reduces heating surface too much, Jack, my boy; but I'm inclined to think there isn't so much gained by jamming a boiler plumb full of tubes as some people think. Fact is, some Englishmen, I think it was, plugged every other tube in a locomotive and ran it with only a small loss in capacity, although 50 per cent. of tube-heating surface was cut out."

Here Uncle Billy hauled out an old note book. "Yes," he said, " 'twas Bryan Donkin, Jr., and Prof. Kennedy., F. R. S., P. Q., an' a few other things, who tested a boiler at Bermondsey, a few years ago. Plugging the flues reduced total heating surface 41 per cent., but the boiler evaporated only 6 per cent. less water than before. The escaping gases were only 5 degrees hotter than before, showing that only a very little less heat was absorbed than with full tube surface.

"Now, I've been thinking about a plan for some time, but I don't s'pose it'll ever be tried, or it might not help things much if it was; but it does seem as if it orter.

"S'pose this is your boiler. Well, divide the tube-sheet into, say, three parts, with a piece of chalk. In the bottom third use a 2¼-inch flue, in the middle part a 2-inch flue, and on top a 1¾-inch flue; but *space* them all same as for a 2-inch flue, say 2⅝ inches from center to center, or ⅝ inch apart.

"This would give ⅜ inch between bottom flues, ⅝ inch between middle flues, ⅞ inch between top flues. The bottom flues would be large enough to have a better draft through them, and wouldn't stop up as they do now. Then the water is cold at the bottom, and as it rises between the flues it gets hotter all the time and needs more room. This gives it. The spacing could be varied to suit; but when I get to owning the road I'll try it, by ginger!" (This was one of Billy's favorite expressions.)

"I know it aint brand new. Some of the old Camden & Amboy engines had two sizes of flues and some three, but this was done so they could gain an extra flue in the corners in their wild chase after a few more inches of heating surface. But I never saw it used as I've told you, and, by ginger! I'd like to see it tried. 'Twouldn't cost much, and ought to save broken backs like yours, as well as help the boiler. Backs don't count, 'cause they come cheap; but when it comes to dollars in time of flue-boring, that's what tells."

I made a sketch as near as I could catch Uncle Billy's meaning. He says it's all right, except I might have laid out the flues in up-and-down rows instead of crosswise—" 'cause they're easier to clean the scale off. But the idea is there, and Billy deserves the credit, if there is any. Don't know as I believe in up-and-down rows anyhow.

Broken Eccentric Straps.

As I have seen nothing lately in LOCOMOTIVE ENGINEERING in regard to broken eccentric straps, I thought I would contribute a few lines.

It is unnecessary to disconnect engine for broken straps, as full train can be taken in without delaying more than ten to thirty minutes. We have some ten-wheel Rhode Island engines which have very heavy blades causing straps to break very often. It is invariably back-up straps which break. Place engine on center, whichever side broken strap is on; put lever in center, take broken strap off blade, plumb link, put a small block between blades, and clamp back-up blade to go-ahead blade. Be sure link is plumb. You will work full stroke on that side, but cannot back up. It would be necessary to notify train master to that effect. Should it happen to be go-ahead strap that is broken, take back-up strap off, and turn it upside down, and put it on go-

ahead cam. Fill cup with oil and cork well. Connect go-ahead blade to strap. Be sure and measure blade from link to inside of broken straps before removing same, and bolt to strap changed by same measurement, and clamp blades same as before mentioned. A. E. LEAVERTON.

Kansas City, Mo.

Central of New Jersey Twelve Wheeler

The locomotive shown is one of a group recently built by the Brooks Locomotive Works for the Central Railroad of New Jersey, and is probably the most powerful locomotive in regular train service.

The cylinders are 21 x 32 inches and the driving wheels 55 inches diameter. The boiler pressure is 200 pounds per square inch. When starting a train these figures show that the tractive power is 43,619 pounds.

The firebox is 123 x 97 inches, giving a grate area of 82.85 square feet. There are 410 2-inch flues, 13 feet 10¼ inches long. The rigid wheel-base is 15 feet, and the total engine wheel-base is 25 feet 9 inches. The engine weighs 201,000 pounds, of which 159,000 are on the drivers.

These engines are pulling trains of 3,000 tons over a somewhat undulating division, and it is expected when the company get a full supply of their new steel 50-ton cars that the engines will take trains of 4,000 tons along without difficulty. Two firemen are employed on each engine.

Care of the Vauclain Compound.

In running a Baldwin compound, look for loose rocker boxes before starting out, especially in a direct-motion engine.

Adjust the poppet valves on the low-pressure cylinder so that they are not too tight. Examine large nuts on high-pressure piston rods. The low-pressure nuts do not work loose readily. The front end of main-rod brasses will need to be reduced nearly as often as the back end, and a loose pin in front end of main rod will make a jar all over the engine when running shut off.

Guides should be kept well lined up, or piston will blow bad. The very best of swabs should be on pistons, and they should be constantly oiled. Valve oil and graphite are excellent for them. If they blow, the engine loses most of her power.

Pipes should be put on cylinder cocks and by-pass valve drip holes to carry all the water away from the rail and sand pipes, or the engine will be very slippery and liable to stop up her sand pipes.

In starting the train, work the engine in simple till you are going five or six miles per hour, then throw her into compound and begin to hook her up. When you throw her into compound, it is the same as hooking her up a notch or two. She should be worked in compound all the time, giving notches on a hill, the same as simple engine, till notches are gone, then engine can be thrown into simple. In slippery weather, after engine is notched down about half stroke, I throw engine into simple in order to get more uniform pressure in cylinders, which prevents slipping and probably doubling.

In drifting down hill with steam shut off, engine should be put in simple, or, better still, cylinder cocks should be opened, and engine will not retard train. The lubricator will feed and should be managed the same as a simple engine.

Vauclain compounds should not be pooled, for they will get nothing but neglect and abuse, and give unsatisfactory service.

Now in regard to break-downs. The breaking of a piston valve is the worst break-down that could be. The breaking of a valve stem inside of the valve is about as bad, as it goes entirely through the heads, being held on by a nut at each end. In that case live steam enters at the holes, making it impossible to keep steam out of cylinders after valve is blocked, unless the holes can be plugged, which would necessitate taking out the valve to plug the other end. With the valve stem broken on the outside of valve, it would be almost self-blocking.

If the valve is broken in two at any of the bridges, the engine will drag or prolong her exhaust on that side, which will be more noticeable in switching with engine down in the corner. All that holds the pieces together then is the valve stem.

A broken packing ring in piston valve will be very hard to detect on account of it not being prominent enough to be easily located.

If a high-pressure piston rod breaks, engine would not have to be taken down on that side. Take off front head, or what pieces are left and remove piston. Plug up the hole where piston went through and put on high-pressure head. (An extra high-pressure head should be carried.) Then when steam enters at one end of the cylinder it passes to the other end (the piston is out, remember), through the valve the same as if it was exhaust steam, to the low-pressure cylinder, making really a high-pressure engine in low-pressure cylinder on that side.

Then suppose a low-pressure piston broke, you would take off the front low-pressure head (or what was left of it), and remove the piston and rod, leaving it out the same as would be done with high-pressure cylinder. But in this case you would not have to carry an extra head, as you can board it up with wood to keep the steam from blowing out of it. Of course the piston-rod hole would have to be plugged up in back head. It is evident that it is unnecessary to take down main rod or eccentrics or to disconnect valve stem, as this gives you the use of three pistons, and you can work her either simple or compound, making an engine on one side only a rare thing.

This would seem to be an ideal engine for long passenger trains where a simple engine on one side could not handle the

CENTRAL RAILROAD OF NEW JERSEY TWELVE-WHEELER.

train a compound could take the train till relieved, by using three pistons.

The time consumed in disconnecting a simple engine where you would have to take down the main rod, and the time consumed in disconnecting a Baldwin compound where you do not take down the main rod is apparently in favor of the compound. A. A. LINDLEY.

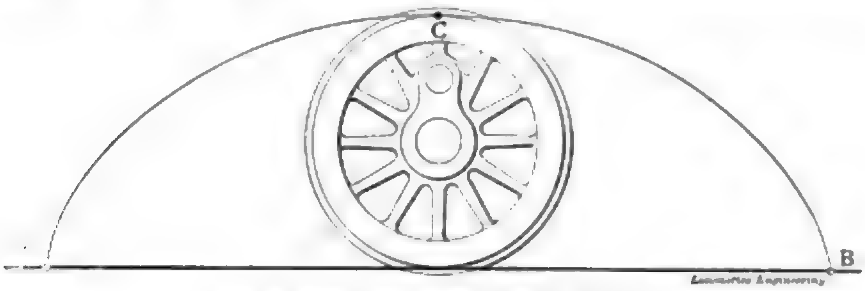
Oskaloosa, Ia.

The Top of a Wheel Moving Faster Than the Bottom.

The question of the top of the driving wheel traveling faster than the bottom has arisen once more, and as an explanation is wanted, the illustration has been made to help make it clear.

Suppose the driver shown be rolled back to *A* so the point *C* is on *A*. Then if it is rolled toward *B*, this point *C* will move through the path *A C B*, as drawn. This is true of any point selected, and that point will follow a similar path.

At the same time the bottom of the driver rolls along the rail from *A* to *B*, which distance is so plainly less than the path *A C B* as to need no argument that the point *C* travels farther in the same time, consequently must travel faster. This curve is called a "cycloid," and measures just four times the diameter of the circle, while the distance A B is only 3.1416+ times the diameter. This makes the path of the cycloid 27.3 per cent. longer than the distance traveled—nearly. This difference in the travel of the top and bottom of the wheel, however, is due solely to the point of view. If we consider the axle as the stationary point, as with the engine jacked up, then both top and bottom move alike. But on the rail the axle is moving along, parallel to the rail, and the point on the rim is leaving the rim and revolving around the moving axle.



TOP OF WHEEL MOVES FASTER THAN BOTTOM.

An easy way of showing this is to take any round object, like a silver dollar, and laying it down flat roll it along the edge of a ruler, keeping a pencil point against some particular point in the rim. This pencil will trace a curve like that shown, showing the path of any point.

After all is said and done, however, the fact remains that from a practical standpoint this is not worth considering, as the drivers drive and the other wheels carry their loads without regard to the cycloidal curve—depending mostly on a good track and plenty of steam in the cylinder.

EQUIPMENT NOTES.

Pressed-Steel Car Company have received an order for forty cars from the Lorain Steel Company.

The Interoceanic Railway have ordered six consolidation locomotives from Schenectady Locomotive Works.

The Lehigh Valley Railroad have ordered 400 40-ton box cars from the American Car & Foundry Company.

The United States Navy Yard at Norfolk have recently ordered a heavy switching locomotive from H. K. Porter & Co.

The Rogers Locomotive Works are to build three ten-wheel locomotives for the St. Louis Southwestern Railway Company.

The New York Central & Hudson River Railroad have ordered twenty mogul locomotives from the Schenectady Locomotive Works.

It is reported that the Terre Haute Car & Manufacturing Company are to build for the Vandalia Line 100 coal cars of 80,000 pounds capacity.

Pittsburgh Locomotive Works have received an order for three six-wheel switching locomotives from the Cleveland, Lorain & Wheeling Railway.

It is reported that the Great Central Railway of England are about to place an order for twenty locomotives with the Baldwin Locomotive Works.

The American Car & Foundry Company are to build at the Wells & French Works 200 refrigerator cars for the Chicago, Burlington & Quincy Railroad, also at the works of the Missouri Car & Foundry Company 100 cars for the National Rolling Stock Company.

The Southern Railway Company have ordered locomotives as follows: Pittsburgh Locomotive Works, seven consolidation; Schenectady Locomotive Works, four ten-wheel passenger; Richmond Locomotive & Machine Works, four ten-wheel passenger and eight consolidation.

The Wabash Railroad Company have placed the following orders: Rhode Island Locomotive Works, fifteen moguls; Baldwin Locomotive Works, five moguls, three compound passenger eight-wheelers and two simple passengers; Richmond Locomotive Works, eight moguls, four of them being compounds.

Mr. G. R. Brown has retired from the position of general superintendent of the Fall Brook Railway, on account of the absorption of that road by the New York Central. Mr. Brown entered the service of the Fall Brook Railway in 1864 as telegraph operator, and he has been with the road ever since. He was successively train-dispatcher, superintendent and then general superintendent. When he became general superintendent the company had been suffering from numerous accidents and wrecks due to recklessness and carelessness. Mr. Brown instituted a rigid system of discipline by means of bulletin-board notices and the keeping of records of the men, but no suspensions were made. The plan worked so well that accidents almost entirely ceased within a few months. Mr. Brown contributed an article to LOCOMOTIVE ENGINEERING in 1896 describing the system of discipline without suspension, which was afterwards published in pamphlet form. Many railroad companies have now adopted the Brown system in full or in modified form.

There was a time, before dining cars became a fad, that the Baltimore & Ohio Railroad's Queen City Hotel, at Cumberland, Md., was noted for its service and cuisine. In latter years, the reputation declined, as few travelers partook of sustenance at the long tables in the big dining room. But an effort is to be made to restore the reputation of the seventies and eighties, and the hostelry has been placed in charge of I. N. Shattuck, who has been dining-car superintendent of several big Western roads. Considerable money will be spent on the hotel, and it will again try for first-class patronage.

The Master Car Builders' Convention will begin at Old Point Comfort, Va., on Wednesday, June 14th, and the Master Mechanics' Convention will begin at the same place on the Monday following. The Executive Committees of both associations have to elect new secretaries in place of Mr. Cloud, who retires.

The four passenger engines built recently by the Schenectady Locomotive Works for the Vandalia line appear to be giving great satisfaction. One of these engines was illustrated in our May number. Mr. W. C. Arp, superintendent of motive power, writing about the engines, says: "We have been unusually fortunate in breaking in these locomotives without developing any defective parts or causing delays to our trains. They have thus far proven to be free steamers with out heaviest passenger trains, and the tank of 6,000 gallons capacity enables us to run these engine 117 miles with one tank of water, the train consisting of seven cars, viz., two postal cars, one combination coach and baggage car, one coach, two sleepers and one dining car.

Creeping Rails on the Eads Bridge.

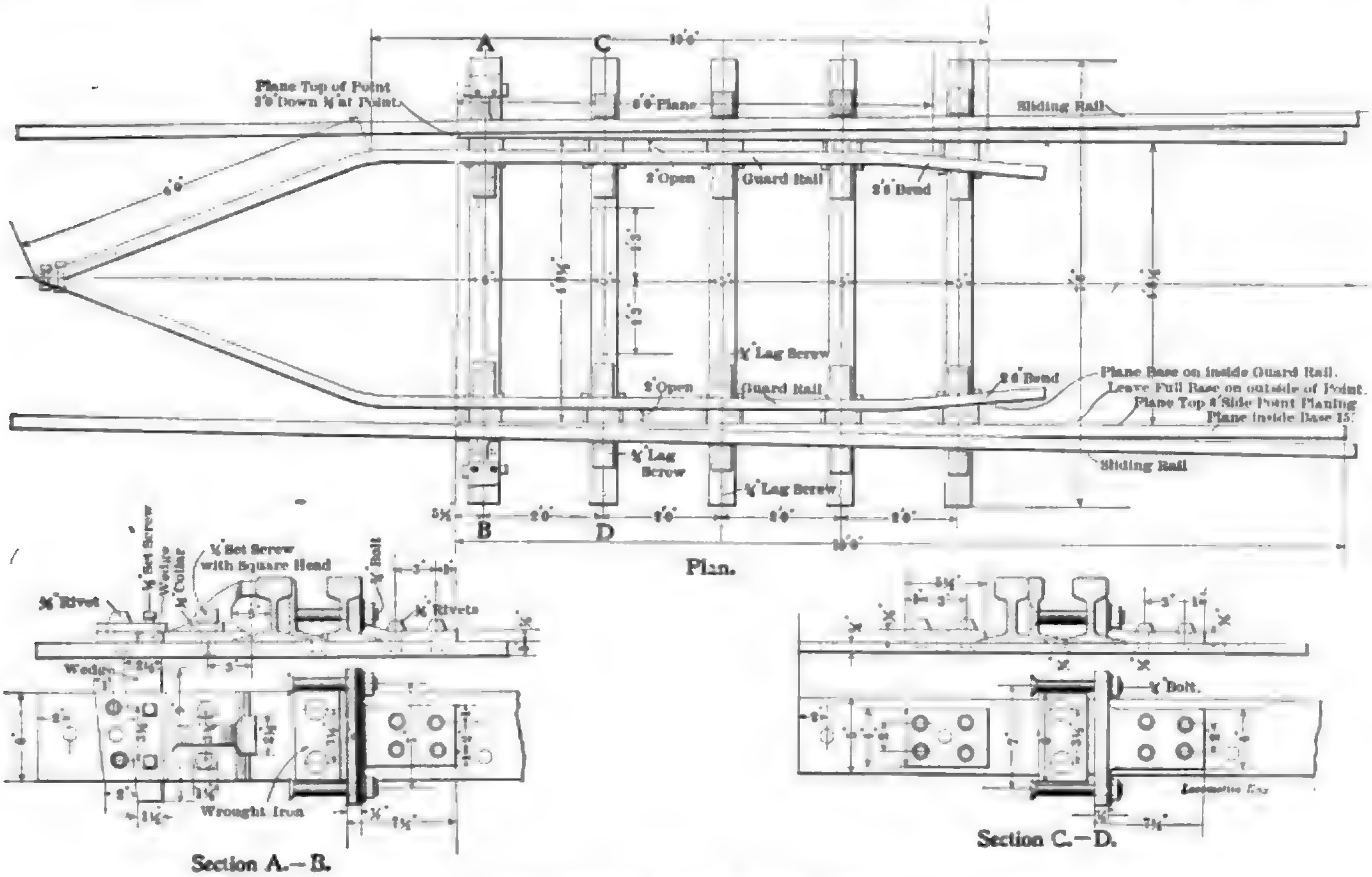
One of the "fishiest" sounding stories we have run across lately is the creeping of rails on the Eads Bridge across the Mississippi, and yet, strange to say, it is borne out by facts and statements that cannot be disputed.

Through the kindness of Mr. N. W. Eayrs, we are able to show the creeping points which are used to take care of this and not disturb traffic. This is so clear as to need practically no explanation, the rails from the bridge simply creeping off and past the points which are securely fastened to the solid approaches at the ends. At the other or rear end (counting the direction of traffic) extra rails are fastened on and are dragged through and into position by the creep of the rails.

When a complete rail-length has been worked through they add another at the tail of the procession and take off the one which has crept through. This one is transferred to the other track and immediately starts back.

There are four of these devices on the bridge, one for each end of each track. These take up the motion of the track over the bridge, a distance of 1,700 feet. At the east end is a double crossover, which is also protected against creep by a pair of these devices, one on each track. East of this, again, is a stretch of about 1,500 feet of track on the east approach trestle, where one of these devices is put on each track. Rails placed in the creeping adjustment at the east end of the west-bound track, go through the straight track around a 5° 45′ curve, 340 feet long, and out again on a tangent, until taken out at the west end of this section of track.

We endeavored to find the relation between the creeping of track and the amount of tonnage hauled over or the number of trains, to try and find some key to the peculiar performance, but have not been able to, as yet. The fact remains that the rails creep from 30 to 60 feet per month, or from 1 to 2 feet per day, so that a rail creeps across the bridge in from 28 to 56 days. It gives one a kind of "creepy" feeling, but the facts stand, and explanations are in order.



CREEPING RAIL POINTS ON EADS BRIDGE.

Water-Tube Boilers Gaining Favor.

Marine engineers insist that an important lesson of the late war is that the ordinary return tubular boiler used in the navy must go and make room for some form of water-tube boiler. Water-tube boilers are greatly favored by many progressive engineers, and we have lately heard considerable talk about trying them again on locomotives, but we doubt if any improvement in steam making or economy of heat could be effected by such a change. A paper was read before the American Society of Naval Engineers lately on "Boilers for the Navy," by Past-Assistant Engineer J. K. Robinson, which seems to demonstrate that the ideal water-tube boiler for naval purposes is entirely impractical for locomotives. He maintains that there should be sufficient grate area provided so that the coal consumption should never exceed 35 pounds per square foot per hour, and prefers that it should not exceed 25 pounds. Locomotives working hard rarely burn less than 100 pounds of coal per hour on every square foot of grate, and the consumption frequently runs as high as 200 pounds per hour. With Wootten fireboxes having extremely large grate area the coal consumption will generally exceed 50 pounds per square foot per hour. From these figures we should conclude that it is entirely impracticable to design a water-tube boiler that would generate the steam needed to pull a fast heavy passenger train.

The following are extracts from the paper referred to:

"The boilers must have a large grate surface so that steam can be furnished with readiness to the engines. To go further, contract-trial speeds should be obtained by burning not much more than 25 pounds per square foot of grate surface under the boilers. This would insure the ability to attain this speed, a maximum speed in practice, without great difficulty. The boilers should be divided into small units so that it will be possible to overhaul them, one by one, without at any time making any great inroad into the steam-producing plant.

"We want to avoid the great fatigue to the men, the great loss of feed water, the rapid fouling of the boilers incident to

their being maintained at all times with lighted fires under them all. We want to avoid any great expenditure of coal incident to keeping the vessel at all times in complete readiness for action. The boilers must be accessible to repairs and cleaning, inside and out.

"To fulfill these requirements we must have boilers that are capable of generating steam quickly from a cold boiler. Such boilers could be maintained with heavily primed fires ready for lighting, but not lighted until required, and such boilers would be capable of furnishing a full supply of steam to the engines at short notice. By the use of hydrokineters the water in these boilers could always be kept hot.

"The wear and tear on the ships would be decreased and could be controlled. The ship being fitted with such boilers, a full watch would not be required at all times in the terrific heat of the fire rooms; having the men within call would be sufficient. The crew would not be worn out with hard work to such a deplorable extent as now obtains.

"As the time required to raise steam from a cold boiler is largely due to the time required to heat to the boiling point the water contained in the boiler, in order to have boilers that will be capable of raising steam quickly, we must have boilers having a small amount of contained water as compared with the cylindrical boilers that are now in use.

"There are many other lessons to be drawn from the late war between the United States and Spain, but the necessity for the use of water-tube boilers is the great lesson to the engineer. To know that certain qualities of this type of boiler must be obtained to insure satisfaction, is also interesting. To have a successful and satisfactory water-tube boiler we must have a boiler that is simple, economical under the ordinary conditions of use, and with as few joints as possible. It must be accessible for repairs and cleaning. It must have large grates, but grates that are short, so as to be easily worked, and that gain area by an increase in the total width.

"There have been experiments with water-tube boilers for years. There is an infinite variety of this general type of boiler. They have tubes of all shapes and sizes, placed at all angles. These tubes are connected with many types of steam and water drums, placed some within and some without the boiler proper. These boilers are supplied with feed heaters, air heaters, and all sorts of economizers. But the boiler that we want, the boiler that we must have, has certain fixed requirements of design. Many of the types of water-tube boilers fail at once to satisfy those requirements. Is there one that will satisfy them all? If there is such a boiler, which one is it? If no such boiler yet exists, what modifications must be made in that type of water-tube boiler that comes nearest to satisfying the requirements to make it satisfactory now and hereafter? For the sake of uniform design, some one type must be found and adhered to."

The Pratt & Whitney Company, Hartford, Conn., have issued an illustrated catalogue and price list of their small-tool department. The greater part of it is devoted to taps, dies and other cutting tools. The catalogue will be a very useful reference to machine shop foremen, tool-room men and other machinists.

The Ingersoll-Sergeant Company, New York, have issued an illustrated catalogue marked "25,000," which indicates the number of machines finished by the company. Besides telling the number of rock drills made, the pamphlet gives a great many interesting facts about the work done by the drills. It will be sent free to friends of LOCOMOTIVE ENGINEERING.

Fig.3. Fig.2.

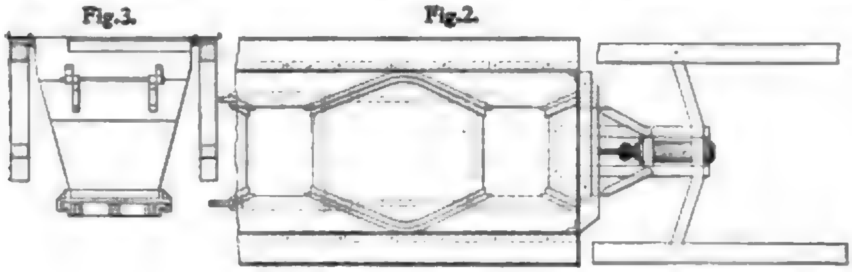
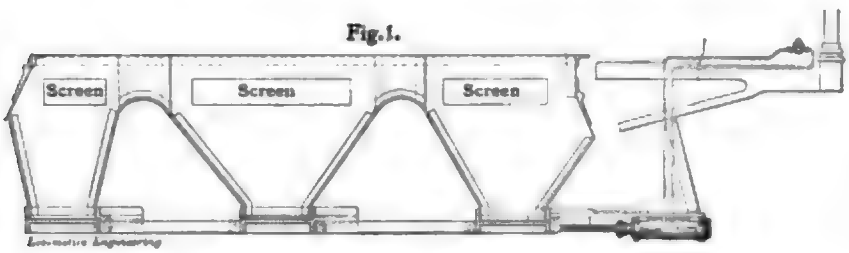


Fig.1.



HEINTZLEMAN'S SELF-DUMPING ASH PAN.

Air-Operated Self-Dumping Ash Pan.

An official of the Southern Pacific writes us concerning the ash pan shown in the annexed engravings:

"Enclosed please find print and specifications of a patent for dump ash pan issued to Mr. T. W. Heintzleman, master mechanic, Southern Pacific Company, at Sacramento. By referring to the print, you will notice the pan is provided with side openings for admission of air, which are closed by screens, fitted with adjustable dampers, to regulate the admission of air to the fire. This arrangement makes the pan absolutely fireproof.

"On locomotives fitted with this device fewer delays are experienced on account of dirty fires; the labors of the fireman are decreased by reason of his not being obliged to 'hoe out,' as with the old style of pans, and can always have a clean fire by slightly shaking the grates and dumping the pan with air cylinder and four-way cock attachment.

"This pan has been designed for locomotives with shallow fireboxes, and can be placed on this style of boilers irrespective of number of driving wheels, for it is made in sections to suit varying distances between axles. Mr. H. J. Small, superintendent of motive power and machinery, Southern Pacific Company, has placed this pan on quite a number of locomotives in service, and also upon the new equipment which has been ordered. This pan has been in use on these lines for about a year, and using it in connection with the 'baffler fire door,' which was adopted some years ago, and has shown very beneficial results, both as to economy in consumption of fuel and absence of black smoke emitted from locomotives. A shallow pan has also been designed for deep fireboxes."

Despite the fact that the mail trains operated by the Chicago, Burlington & Quincy Railroad between Chicago and Council Bluffs are the fastest in the country, their engineers experience comparatively little difficulty in keeping them on time. One of the two mail trains, No. 7, has been late but once this year. The other, No. 15, is an hour faster than No. 7, but its showing is almost equally good. Four times only, since January 1st, has it failed to make its schedule of 500 miles in 10¼ hours.

The Pressed-Steel Car Company have arranged to have a comprehensive exhibit of its various styles of cars at the Old Point Convention. Not only will their types be shown in new cars, but a complete series of cars manufactured early in the history of the company and since then in use by prominent roads, will be exhibited. The cars will be sent to Old Point in exactly the condition in which they are received from the roads, in order that there may be, for the benefit of rail-

road men, an ocular demonstration as to how the cars were in service. Of the old cars to be on view the Pennsylvania Company will contribute one; the Baltimore & Ohio Railroad, one; the Pittsburgh, Bessemer & Lake Erie Railroad, one self-clearing hopper, and the Lake Superior & Ishpeming Railroad, a designed ore car. The exhibit will be not only interesting but instructive.

Tongs for the Railroad Blacksmith Shops.

BY JAMES RAHILLY.

I do not approve of the system in vogue in many shops of cutting down the number of tongs that experience has shown to be almost a necessity—at least an economy. The good blacksmith will keep his tools in good shape, and will also keep his forge looking respectable. An untidy fire shows the lack of system on the part of the blacksmith.

A convenient tool and tong is shown in Fig. 1. It is easily made and should be at every forge, so that all tools except the ones you are using can be kept in the rack, where you know where to find them.

Locomotive work requires a variety of tongs, such as round, square, clevis and collar tongs. As much repair forging is done from old axles, round tongs will be first considered. There should be a complete set of round tongs from ⅝ to 4½ inches, by eighths, and from this to 7 inches by fourths. The size should be stamped on the reigns (or handles), as well as the fire to which they belong. The proper shape is shown in Fig. 2, which is also the shape for square bars, except that the jaws are V instead of round. One set of these should accommodate a good-sized shop.

All tongs should be forged solid from soft steel. Flat tongs should have lips, and in fact the following points may be followed to advantage:

1. The lips must grasp firmly the piece held.

2. The reigns shall be swaged their full length.

3. They should taper (edgewise) their whole length.

4. When firmly grasping a piece the reigns should be parallel and not be wider than 2 inches.

5. The reigns should be in line with center of piece held, and should have enough elasticity to be springy with the firm grasp of the hand.

In making such tools a man should finish them carefully, as they are used every day and do not want to be clumsy or rough. In forging a pair of 3-inch tongs proceed as follows: Take a piece of 2-inch round stock and swash it down under a hammer to twice the thickness of the reigns (in this case this would be 1¼ inches), and let it spread as it will. Then turn it edgewise and fuller it to the right depth at the beginning of the flat part. Turn it upside down and move fuller to the right enough to allow thickness for jaw and fuller this down about 1 inch. Then take a set and bring stock to the center, like Fig. 3, and turn to the left. With a set laid diagonally across the point *A*, Fig. 4, sink it down to the right thickness. Then draw out your reigns; this is the work of one heat. Forge two like this.

The jaws should be finished first, before either the reigns or lips. For this you want a 1-inch bottom fuller, about 4 inches high. Lay your piece on top, as in Fig. 5, holding at *A*, and work this cornerwsie and round, so as to agree with the inside circle after it is turned upside down on the horn. Work the outside corner pretty well to a square, allowing sweep enough not to bind when riveted. See how high it is to the fuller print to the tips when the reigns are on the anvil. They should be 2½ inches high for these tongs. If they are right, swage up the reigns in good shape, cool them off and finish lip. Cut off the stock long enough for lips. Cut stock down like Fig. 6, then take fuller and spread it out. Take it to hammer and lay it on anvil, as Fig. 7. Draw out thin from each side, leaving it thick in middle. Take tool like Fig. 8 (end view); lay jaw in this die and hammer it out. Then bend lips to fit the size piece it is to hold (3 inches in this case). Have both pieces exactly alike.

The reigns should not open wider than is necessary to give the jaws room to grasp the piece they hold. Lay out the holes 1 inch from the outside of the reigns, then punch the holes. After the lips are swaged and trimmed the tongs are finished.

There are many other ways of making tongs, but this is my choice after trying them all. Flat and clevis tongs are easily made and hardly need any description. The same can be said of collar tongs, which are really modifications of the round tongs. There is little demand for them in new work, but on repair work they all come in handy.

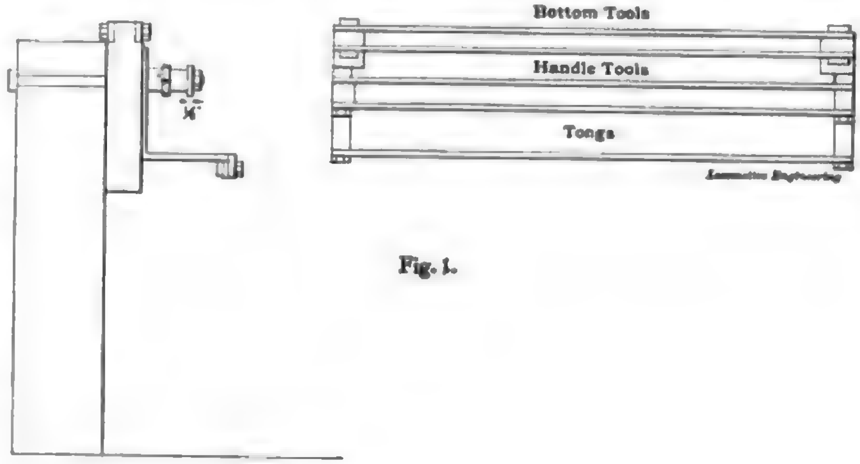


Fig. 1.

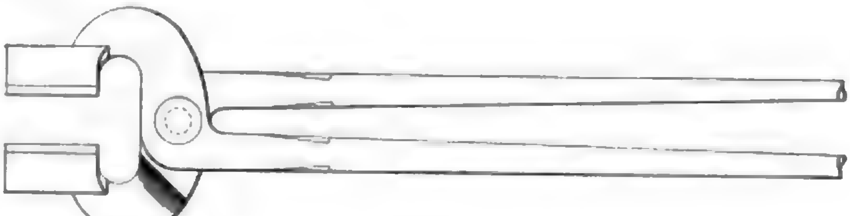
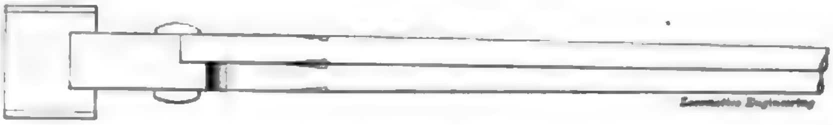


Fig. 2.



BLACKSMITH TOOLS.

The closing lecture in the course of special railway lectures at Purdue University was delivered on May 2d by the Hon. D. P. Baldwin, of Logansport, Ind. Judge Baldwin, who is a close student of economics, took for his subject "Railway Prejudices," treating the subject from the standpoint of the general public. He gave the history and causes for the prejudices which very generally exist in the public mind against railways, showing that these prejudices were in the beginning well founded, but that in later years conditions had materially changed, and that methods of railway management and operation were no longer subject to the abuses which held in former years. The subject was ably handled, and the case of the people was stated with fairness and impartiality.

Investigating Smokeless Firing.

We have received from Mr. C. H. Quereau, master mechanic of the Denver & Rio Grande, the copy of a report made by Mr. J. T. Slattery, one of his firemen, on the method of firing followed on the Burlington, Cedar Rapids & Northern Railway. In writing to us Mr. Quereau says:

"I did not at all doubt your article, but thought it wise to convince my firemen that it is practical by sending one of their number to investigate. Already a number of my men practice the method successfully, and others more or less; so I look for a decided improvement in our fuel records as soon as they all take hold."

The following are extracts from the report:

"I herewith submit a report of the one-shovel system of firing engines on the Burlington, Cedar Rapids & Northern Railroad, as observed by me: I left Cedar Rapids, March 9th, at 1.30 P. M., on train No. 9, engine 179, twenty-seven loads and five empties; rode 37 miles on this engine, making a run of 23 miles in 1 hour and 20 minutes. I got up on the engine as soon as she came in the yard to go out; looked in firebox. The grate surface was covered by about 3 inches of fire. There were two gages of water in the boiler. The fireman put two shovels of coal in the firebox and turned on the blower, and kept adding to the fire one and two shovels at a time until the engine was hot. The injector was started and kept working until there were over three gages of water in the boiler; by that time the air was tried, the engineer had his orders and was ready to go. As he pulled out, the fireman kept building up his fire, one and two shovels to a fire. He made very little black smoke. As soon as the engine was hot the engineer put his injector to work and kept it working, but was constantly regulating the flow of water by the lazy cock. On going up a heavy grade he would cut the water down, and while going through a sag he would work it full and hook his engine up. All this time the fireman maintained a very even pressure of steam, varying only a few pounds, never using more than one shovel of coal to the fire and making no black smoke. While going up a heavy grade the engineer would begin to drop his engine one notch at a time until he got her down where he wanted her. This engine made one mile in three minutes on seven shovels of coal, and one mile in four minutes on six shovels of coal. The engineer and fireman both said they liked the new system better than the old because it was saving of fuel, and they did not have to stop and clean fires as before.

"The engineer said they used to stop and clean the fire and blow out the front end about every 50 miles under the old way, while now all they had to do was to clean the ashpans two or three times on a 155-mile division.

"The coal was all cracked and put on the tank in good shape. There are coal gates on all tenders, so the coal works down as fast as it is used; all the fireman has to do is to watch his fire and put in the coal. The fireman always knows the orders, and when the engineer is going to stop, he always calls fireman's attention to the fact. Just before he shuts off, the fireman opens the blower and latches the firebox door; in this way there is very little black smoke around stations. I returned to Cedar Rapids on train No. 10, engine 175, with twenty-eight loads. This engine did not steam as freely as engine 179, and had to be favored by shutting off the injector. This engine had been out of the shop over two years. The fireman on engine 175 used but one shovel to the fire, but made some black smoke, as he put his fires in closer together. I asked the fireman if the engine would not do better if he were to use three shovels to the fire. He said he would try it, and did so for a few miles, but the results were not as good as before. I told him he had better fire the engine in his own way, and he did so, with about the same results. While the engineer stopped to take water, the fireman put on the blower and got his boiler well filled. He had no more trouble the balance of the trip, about 23 miles. While making this trip I met engine 170 with a train of thirty-two loads, engine 53 with a passenger train of three cars, engine 72 with a train of thirty-five loads, and engine 190 with a train of thirty-two loads and five empties. There was no black smoke from any of these engines. Mr. J. H. Burns, assistant master mechanic, told me all the engineers and firemen were using the one-shovel system.

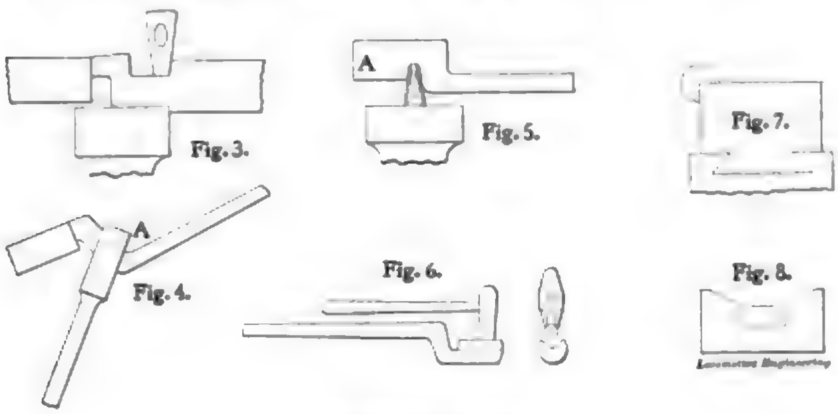
"I left Cedar Rapids March 10th at 10 50 A. M., train No. 9, engine No. 170, with thirty-three loads. This train was ready to pull out when I got her. The fireman had his fire well built up; engine was hot, and injector put to work as soon as train was clear of the yard. We made the run of 24 miles in 58 minutes. The engine was hot all the time, and never had less than three gages of water. The door had to be latched several times to keep the engine from blowing off. The fireman never used but one shovel of coal to the fire, and made no black smoke.

"My next ride was on engine No. 72, train No. 67, with twenty-eight loads. I caught this engine out on the road and rode seven miles in the way-car. Neither the engineer nor the fireman knew there was anyone except the crew on the train. There was no black smoke. Finally, I went over on the engine to see how she was fired. They were climbing a very heavy grade and the engine was being worked very hard, but the pointer was at 180 pounds with three gages of water in the boiler. Pressure was maintained with one shovel of coal to the fire, and no black smoke. I rode to Traer station on this engine, where Mr. J. H. Burns, assistant master mechanic, had provided lunch for two, which I enjoyed very much after my ride of 47 miles on an engine.

"I returned to Cedar Rapids on engine No. 193, train No. 66, with thirty-five loads. This engine did not steam very well and the fireman had to work pretty hard, and the engineer had to watch her very closely. Nevertheless, they made a good run. They had lots of picking up and setting out to do, and this helped them to keep the boiler well filled. I learned from several other men that this is considered one of the best crews on the road. I asked the fireman if the engine would not do better if he would use two or three shovels of coal to the fire, and he said he would try it if I wished, but he knew she would not do as well, so I told him to fire his own way. The run of 18 miles was made in 55 minutes on the last end of the division. We arrived at Cedar Rapids at 7 P. M.

"March 11th, left Cedar Rapids at 8.05 A. M. on train No. 1. The fireman built up his fire by placing one shovel of coal in firebox at intervals of a few minutes, and by the time the train was ready to leave, he had his fire in good shape, and had made very little black smoke.

"This train consisted of five cars, and made the run of 31 miles in one hour, including five stops. This fireman was a new man on this run, but never used more than one shovel of coal to the fire. He pumped the engine himself and kept the

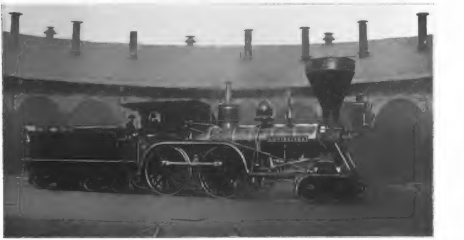


BLACKSMITH TOOLS.

injector working all the time, except when pulling out of stations. He maintained a pressure of 155 and 160 pounds all the time. I rode to Mount Auburn on this engine.

"I returned to Cedar Rapids on train No. 4, engine No. 30, with four cars. We made the run of 31 miles in 1 hour 5 minutes, including five stops, and taking the siding to meet train No. 51. This fireman had no trouble in keeping the engine hot with one shovel of coal to the fire. They had come a distance of 124 miles when I got on the engine. Fireman had a nice, bright fire, and you would not think he had gone more than a few miles. I looked at the ash-pans when we arrived at Cedar Rapids and they were a little more than half full after the run of 155 miles. The engineer told me that they were making a very noticeable saving on coal, and his engine steamed much better than under the old way of firing. The fireman said he liked the new system better than the old because it was not so hard to keep the fire clean, but said he never had much trouble for steam, as he did not believe in loading an engine. He had been firing about six years, while the engineer had been running an engine about eighteen years on this road. On approaching stations the same rule was observed as is practiced on all engines. The blower was opened and the fire door latched to prevent black smoke when the engine was shut off. The engine was pumped by the engineer on this trip. I rode on this same engine with the same crew several days later. The engine was fired with one shovel and made no black smoke. She was pumped by the fireman on this trip. I returned to Cedar Rapids at 10.15 A. M., and spent the rest of the day around the shops. That night I rode 75 miles on a Chicago, Milwaukee & St. Paul train. They do not fire with one shovel, but fire in the old way; but did not make much black smoke, as they only had three cars, and the engine did not have to be worked very hard. The fireman said his road was looking up the one-shovel system. Several of their men had tried it, with some success, but did not practice it very much.

"I rode 97 miles on an Illinois Central train, No. 3, with seven coaches. The fireman said he did not believe he would be able to keep the engine hot with one-shovel fires, as he had a big engine and a hard run, but said there was plenty of discussion of the one-shovel system, and some of the firemen were trying it at times on freight runs, but did not have much success."



AN OLD CUYAHOGA FOR THE CLEVELAND, COLUMBUS & CINCINNATI RAILWAY.

An Old Cuyahoga Locomotive.

This is from one of the few photographs in existence of the old Cuyahoga engines, and we are indebted to Mr. Oliver D. Herey, of Columbus, Ohio, for the use of this.

The "Louisville" was built in the fall of 1851 for passenger service on the Cleveland, Columbus & Cincinnati Railroad, and was run by Engineer Horton Loomis (called "Pap" Loomis by the boys). Mr. Herey writes us that he fired this engine in 1855 on the night express for Engineer S. B. Alder, who was afterward killed at Shelby.

The picture shows the engine as originally built, except the running board and cylinders. The old running board went out square to the check, and the steam chests were inside of smokebox. They had to be covered with clay to keep the cinders from burning them out. When valves were faced the smokebox front had to be removed to get at them.

This is a neat looking engine in most ways, and will probably recall old memories in the older readers. The acorn-shaped sandbox is a novelty, and the whistle over the bell seems odd nowadays, although this was done by other builders in the earlier days.

Broken Valve Stems.

I do not agree with Mr. C. G. Herman in April number of LOCOMOTIVE ENGINEERING, where he says: "This engine will haul a train when one valve-stem is broken, and the break does not interfere with valve-stem packing, and I believe it will run with both valve-stems broken in same way. She will go all right after you get her started."

Now, I had a break-down with a Vauclain four-cylindered compound, where the valve-stem broke inside of valve (the valve-stem runs clear through the valve, which is not shown in the cuts), and the valve broke in the bridges between second and third packing rings from front end.

Now, according to Mr. Herman's theory, all I would have to do would be to let the steam shove the piece of broken valve back and then let the valve-stem shove the valve and piece ahead, and it would work all right; but it won't.

There is the hole where the piece of

valve-stem came out of to let in live steam into the inside of valve, which will go to exhaust side of high-pressure piston and receiving side of low-pressure piston, and also making an equalization of pressure on high-pressure piston, and also making the same amount of pressure on the receiving side of low-pressure piston as on the receiving side of high-pressure piston on opposite side, which, owing to the difference in the diameter of the piston, will prevent the engine moving.

The only thing to do, then, is to disconnect the valve-stem and block the valve in the center, and by taking a very light train and working a light throttle, it would not be necessary to take the main-rod down.

A. A. LINDLEY.

[The case referred to by Mr. Herman in his article was a break *outside* of stuffing box. If Mr. Lindley will read carefully further down in the article, he will find this explained.—Ed.]

Boiler, length over all—18 feet 4 inches.

Boiler, diameter—38½ inches.

Firebox—Horse-shoe form.

Length, inside—42 inches.

Width, inside—34 inches.

Depth, inside—58 inches (crown to gate).

Boiler center, above rail—63½ inches.

Bury dome at rear, diameter—38 inches.

Bury dome, height above boiler—26 inches.

Small dome on top of Bury dome—12 by 14 inches.

Small dome at front, diameter—18 inches.

Small dome at front, height—30 inches.

Cylinders, diameter—17 inches.

Cylinders, stroke—22 inches.

Cylinders, pitch—26½ inches in 10 feet.

First to second drivers, centers—54 inches.

Second to third drivers, centers—48 inches.

were combined in the earlier form of Baldwin's flexible truck, which had the springs above instead of under, as in his later practice. The weight of the engine was transferred to the third and fourth pairs of drivers through two large half-elliptic springs, one on each side, which were placed above the frames with an end over each journal box and the center of each spring fastened to the frame.

Two full-stroke pumps, driven by brackets attached to the piston rod, supplied the boiler, and the working barrel of these pumps formed the guide upon which the crosshead worked. As originally built, a safety valve was placed on the top of the rear dome, and another on the top of the front dome. No bells were used at first, and the large square sandbox was midway between the domes.

As the outside of the rear bumper was only 30 inches from the firebox, the cab covered almost the entire dome. Small

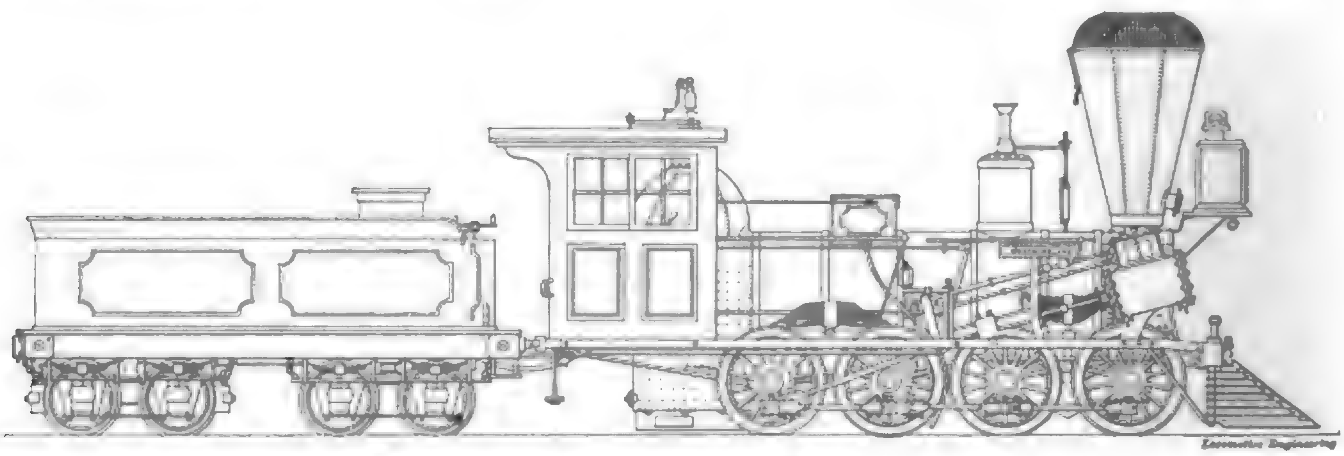


FIG. 1. OLD PENNSYLVANIA ENGINE.

A Baldwin Freight Engine of 1850.

From 1848 to 1850 there were built at the Baldwin shops three locomotives, "Dauphin," "Perry," and "Westmoreland," bearing construction numbers 333, 334, and 357, respectively; and another named "Baltic," bearing construction number 366. These engines were of the Baldwin E type, that is, had four pairs of coupled driving wheels and no trucks. They differed, however, from others of the same class in having all the driving axles placed forward of the firebox, and in having the eccentrics and the main pins on the rear pair of drivers, instead of on the third pair, as was customary on most of the other Baldwins of the class.

The first three were placed upon the Pennsylvania Railroad, but after a short service the "Dauphin" and "Perry" were sold to the Philadelphia & Reading Railroad, and replaced by two of same names, but different types.

The "Baltic" was built for the B. & S. Railroad, probably a line absorbed later by some of the trunk lines.

The principal dimensions of these engines were as follows:

Third to fourth drivers, centers—48 inches.

Weight of engine—50,975 pounds.

The cut-off was of the Baldwin half-stroke type, and the valve worked on a partition plate in the steam chest, but the rocker arm which moved it was not placed aft of the full-stroke rocker, as on most Baldwins, but both worked in the same journals, as shown by the small cut. The shaft of the full-stroke rocker was large and hollow. It worked in the journal boxes on the frame, and its hollow center formed a journal in which the shaft of the cut-off rocker vibrated. The inner ends of the cut-off rockers were carried in a bracket under the center of the boiler. I cannot say whether this arrangement was retained on the "Perry," "Dauphin," or "Baltic," but on the one retained by the Pennsylvania Railroad Company, the "Westmoreland," it was soon removed, and only the full-stroke valve used until 1863, most probably because the engine proved unsatisfactory for road service and was always used as a shifting engine in the Altoona yard.

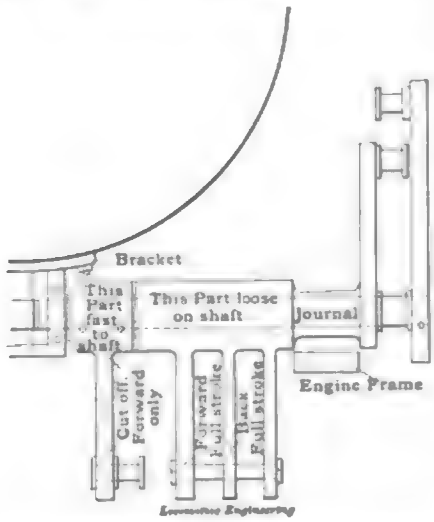
The first and second pairs of drivers outside or auxiliary frames, 1 x 4 inches, extended from front to back bumpers. The boiler and the small dome forward were covered with Russia iron, held in place by bands of brass. No covering of any sort was used on the cylinders or "Bury" dome.

The cylinder cocks and try-cocks of the pumps were not connected to the cab by rods, as now, and their use was only obtained by a trip out along the engine side. The valves were all worked by hook motion of D type, with "starting bars" in cab. The hooks were connected by links having slotted holes in one end to arms on tumbling shaft, to which reverse lever was connected.

The tenders were of eight-wheel type, with two iron frame trucks having a 28-inch half-elliptic spring over each journal box. The cistern held 1,600 gallons of water, and the coal space was proportionate. They, like the engines, were painted green, but did not have either the name of engine or of owner painted on them at first. The engines' names were on brass plates on sides of boilers.

In 1864, Mr. J. P. Laird, then Pennsyl-

vania Railroad master of machinery at Altoona, remodeled the "Westmoreland." He placed a square saddle tank on the boiler, removed the small front dome and the third pair of drivers, placed the sand-box around the saddle of the Laird stack, which replaced the old balloon type; substituted link motion and a Sellers "squirt" for the hooks and pumps, put on a new cab having side doors and a coal bunker behind on an extension of the frame back of the rear bumper. He also added a bell, and casings for steam chests, cylinders, and cylinder heads, and his pet form of guide for that removed with the pumps. He painted her a dark brown, with black



ROCK SHAFT OF OLD PENNSYLVANIA ENGINE.

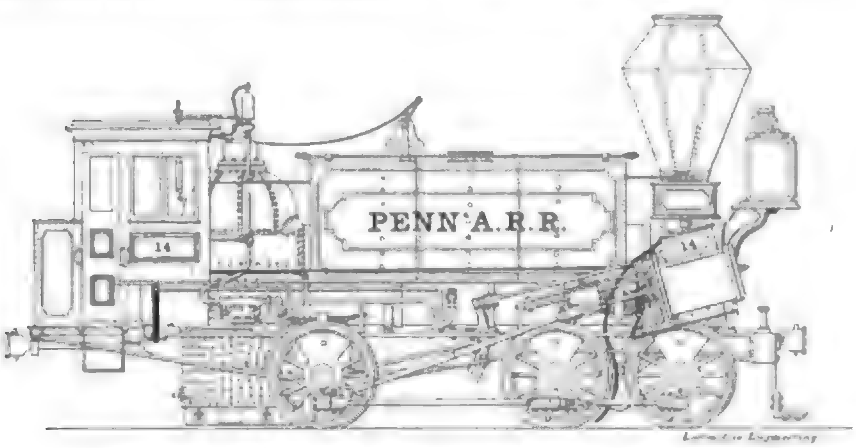


FIG. 2. OLD PENNSYLVANIA ENGINE.

wheels, the whole ornamented with neat stripes and letters of yellow, supplemented by small lines of vermillion. In this rebuilt form she ran in Altoona yard, until finally put out of service about the latter part of 1866 or early in 1867.

C. H. Caruthers.

Lansdowne, Pa.

Among the appliances recently placed by the Buffalo Forge Company was an order for two fans having direct-attached double-upright double-acting enclosed engines of the United States Navy type, which was sent to Johannesburg, South Africa.

Keeping on Good Terms With the Engineer.

BY R. H. ROGERS.

From the first day when Hobart Hodges came to fire on the D. L. & S. system there was but one appellation bestowed upon him. By shopmen, firemen, engineers, *et al.*, he was called a "queer" fellow. Just what his queerness consisted of is perhaps hard to explain. He was "queer," inasmuch as he tried so hard to please his engineer, and very queer in the eyes of his fellow workers from the fact that a hard word from the important individual mentioned would cause him to wear a long face for a week.

Hodges was often severely censured by his comrades, the other jackies, just because he got along so well with all the engineers whom they had pronounced old cranks and not fit to ride on the same engine with (the D. L. & S., by the way, having more than its share of disgruntled pullers of the throttle). Every railroad division of a hundred miles or less has one or more engineers who are the terror of firemen and foremen generally; but it is safe to say that no matter how unfavorably they might have regarded Hodges on the start, he eventually won them over, and simply by humoring their pet hobbies.

For instance, one day when firing extra, he was sent out with old "Pap" Burns, who ran the "837" on the main line local. The peculiarity about old Burns was that he was helpless. He wanted his fireman to almost breathe for him, and in these days of brotherhoods and "our rights" it is very hard to secure an accommodating individual even in a fireman.

So old Burns seldom had the same man more than one trip. Of course his regular fireman knew how to take him and humored him in his whims; but when the former had the misfortune to strain his back, necessitating his laying down the shovel for a long time, there was a different fireman on the footplate of the "837" for nine successive trips.

The roundhouse foreman was in a quandary. After exhausting the entire extra list and being unable to find a man acceptable to the above mentioned ogre of the

throttle and lever, he one day climbed the steps of the master mechanic's office for a consultation.

"Burns is a valuable man and must be humored," said the latter functionary, after listening to the doleful tale of his subordinate; "besides, he is a friend of the superintendent, who wants him to run here. We certainly can't take him off until we exhaust the entire system of men. Haven't you any more extra firemen lying around?"

"I've got this man Hodges down in the 'narrows' firing the gravel train; but George Davis would disrupt the place if I should take him off."

"Well, you'll have to do it. Send for him to-night and tell him he must go out on Burns' run in the morning. I am glad I aint in his place though," added the master mechanic, reflectively, for he had occasionally taken a ride on Burns' engine and knew what the latter expected of his coal-passer.

Hodges went out as per order, and there was any amount of gossip and small talk around the roundhouse stoves that night, to the effect that with his return his previous good record in the line of making himself solid would be forever shattered. Strange to say, however, when Burns returned the next day he said he was a good man, adding, to the unbounded surprise of the engine dispatcher, that he would take him another trip. The second trip brought the revelation that he was again a good man, emphasized by a certain adjective which, if it must be said, is oftener in the mouths of railroaders than their prayers, and with the assertion that he would keep Hodges on the "837" until his regular fireman was able to work again; all of which was very pleasant to the master mechanic.

A few days later, when continued good reports had reached his ear from the foreman and dispatcher regarding the new hit which Hodges had made, the master mechanic sent for him to come upstairs.

"Mr. Hodges," he said, "you certainly have surprised me, and I may add the entire division by the way in which you have ingratiated yourself with the most disagreeable men on it. I am told that you study to please. You don't look like a man who would try to please everybody, so why do you especially try to please engineers? Of course," he added, with magisterial severity, "every man wants to keep his job. I would like to know, however, the secret of your success."

Hodges meditated for a moment. He seemed uneasy, and his features gave every indication that he was haunted by unpleasant memories.

"Mr. Moore," he finally replied, "I fired several years before I came on this road, and in that time I had an experience which I will never forget. Bad feeling existing between myself and my engineer, who is now dead, resulted in my becoming a miserable man for life, and though I was not to blame for what happened, I determined at any sacrifice, and as long as I staid in this business, to try to get along with the man whom I might be assigned to fire for in the future. If you have nothing more to say to me I must go down in the shop and get the engine ready for the road."

Of course this story was told in the presence of the master mechanic's private secretary, a callow youth who sometimes talked too much. He didn't fail to mention the conversation to the storekeeper's clerk, his closely affiliated pal, and so, by gradual transition, it was the property of the entire station.

Hodges became at once a man with a past and with a history, and as it takes very little to throw a glamour of mystery about anyone in a railroad shop, where there is so little to talk about outside of the work, he was soon the object of all the small talk of the roundhouse. Nothing, however, would break down his reserve, and weeks passed before the story was finally told. In the meantime he continued on the "837," and nightly Burns indulged in his ecstacies over the pearl he had found in this eccentric individuality.

One night, however, when a blizzard raged outside and the fierce gale swept siftings of snow through the ventilators and windows of the dilapidated old shop, there was a crowd of more than the usual number of engineers, firemen, machinists, wipers and so on, gathered around the cheerful glow of the red-hot stove, one of the number which, completely encircling the roundhouse between the tracks, glimmer brightly on winter nights. In due time the "837," in from her round trip, was placed on the pit by the hostler, where she would remain until morning. Hodges always wiped off the jacket before going home for the night, and, this work done, with his overalls under his arm, he approached the crowd lolling indolently on trestles before the blazing stoves.

"Boys," he said, "I hear that I am talked about a great deal among you all, simply on the ground that I try to please. You wonder how I get along with Collins, Hardcastle and with Burns. There was a time when I had no such luck, and from the experiences of that time I have learned such a lesson that there is nothing I would not do to keep peace between my engineer and myself.

"I went on the road because I liked it, and because it paid better. In due time I caught a fast Western express, No. 1, over a division 102 miles long. It was on this run that I experienced the greatest scare that I have ever known.

"It is a curious story. I had been firing for Hoskins—that was his name—for five months, and during the most of this time not a word had passed between us. There was bad blood from the start, and our animosity was proverbial on the division. Although I didn't try as hard as I do now to please, I tried to please him. He dis-

liked me from the start, however, and we soon stopped speaking.

"I suppose you can realize what that means. Day in and day out, we traveled through the world at a mile a minute clip, staring death in the face, for five long months, and never heard each other's voice. I suppose that I oughtn't to talk about the man now that he is dead, but he certainly made life miserable for me. Anything that he could do to make me fail for steam, so that the master mechanic would take me off the engine, would be done.

"The chances I have seen that man take to get rid of me would scarcely be believed. He would run his water down to the lowest gage cock, then start both injectors at once, filling her to the brim with cold water. The harder, however, he would work to kill her steam, the harder I would fire, until finally he abandoned this plan and complained to the master mechanic.

"'Mr. White, I want that man off my engine.'

"'What do you want him off for; aint he doing his work?'

"'Yes, he keeps the engine hot.'

"'Well, then, wait until he fails. You do your work as well as he does his and there will be no trouble.'

"From that interview he was in an even worse humor than ever. When we left the roundhouse on that fated day, which I will never forget, to back down against our train, he scowled at me so vindictively that several men who were standing around said:

"'You had better give that engine up. Hodges; Hoskins has no use for you and he will do you if he can.'

"'I am not at all afraid of him,' I replied. 'I can hit as soon as he can. He has his back turned to me on the road, you know.'

"What a foolish remark that was! How meaningless at the time, but when viewed in the light of the later events of that day, how significant and how incriminating to me!

"That day we started out eleven minutes late and with two extra cars. I knew that he would plug the life out of her, and tried to prepare my fire accordingly. The run was the hardest on the road, over a hilly country where a minute lost on the almost impossible schedule on which we ran could never be picked up again. Our engine was a ten-wheeler, a powerful machine, with the boiler extending to the back door of the cab, so that when I stepped up on my side it rose between Hoskins and me so high that only his head and shoulders were exposed to view. But I was not often up there. I was always on the footplate firing, seldom having the shovel out of my hands on that run over the entire division.

"As I said we were eleven minutes late when we got the whistle. The first eighteen miles were up a 40-foot grade to the mile and the running time was twenty-five minutes. To pass Rockwood, the summit, on this time was to make a phenomenal run. Leaving there the grade changed and went down very steep to Gaitherstown, where double track ended and single track began. The train we were hauling was the Cincinnati fast mail. All the bags were snatched from the cranes by the apparatus on the mail car while running at the rate of sixty miles an hour.

"Although we were late and it was as much his interest to make the run as mine, he resorted again to all his old tactics. The way he dragged that train up the hill was scandalous. Several times the steam dropped ten pounds, once twenty. Then he would let his seat down, come to the back door of the cab and watch me working, perspiration streaming from every pore, and with such a sneering expression on his face that I was several times tempted to hit him with the shovel.

"However, before reaching the top of the hill he sat down again, leaning half way out of the window as usual. I wasn't at all sorry when we reached the summit, and noted with satisfaction that we had made running time after all. I knew that he would shut her off down the hill, which would give me a brief rest from the incessant work of shoveling coal and a chance to get my fire in shape, already dragged full of holes. I was about to step into the cab as we started down the grade, but to my surprise the sound of the exhaust informed me that the throttle was still wide open. I attached no importance to the matter, however, although it was a departure from his usual custom. Thinking that he only intended giving her a good start down the hill, I opened the furnace door and threw in a couple of more shovelfuls. We gained in speed, but I did not think of looking toward his side of the cab.

"'Old boy,' I thought, 'if you insist on pulling her, I can ride as fast as you can.'

"But the pace soon became terrific. Down that heavy grade, pushed by seven Pullman cars, the big locomotive under the impetus of the wide-open throttle flew like a meteor. I never rode so fast in my life before or since, and finally I must admit that I became alarmed. I didn't want to speak to him until he spoke to me, but I didn't want to get killed either. So I finally stepped into the right side of the cab.

"I was confronted by a startling spectacle, which under the circumstances was doubly appalling. Hoskins was lying or half hanging out of the window. Indeed, his head and shoulders and the upper part of his body were so far out that had his left leg not been caught in the reverse bar he must have fallen to the ground. His arms hung straight down on the outside and his cap had fallen off.

"Ahead down the track lay Gaitherstown, a red signal flashing from the tower, while we flew down upon it on the wings of the wind.

"In a moment I had dragged him inside

and closed the throttle. Then I saw his condition. A ghastly wound on the forehead had crushed his skull, while a similar one, though not so extensive, extended from the base of the skull upwards in the back. I realized in a moment what had happened. You know how close the mail bags hang to the train before they are caught by the crane on the car. No doubt it was one of these which had struck him on the head causing the terrible tragedy. I remembered that there was one just before we got to Rockwood, and he had probably been hit there, a mile before we turned over the hill.

"But there was little time for reflection. I tried hard to stop the flying train, but a strange thing happened. Although terribly injured, as he was, Hoskins feebly extended his hand and pulled open the throttle. He then settled down on the seat dead.

"Luckily there was still time to come to a halt before reaching the end of double track, for had we dashed through that network of interlocking switches at that rate of speed the whole business would have been in the ditch.

"Immediately after we stopped, the conductor, passengers and the majority of the inhabitants of Gaitherstown surrounded the engine. You have no idea how they looked at me, particularly the former. I then realized my position exactly, but all the more forcibly was it brought home to me when the mail clerk, whom I knew very well, and who had overheard my unfortunate remark before we left the terminus, said:

" 'Old man, this looks pretty bad for you.'

" 'What do you mean,' I said. 'I couldn't help the man being struck by the mail bag.'

" 'I hope you can make them think the same, but there are two cuts in his head, and you know that they will say the mail-bag could only have made one.'

"Yes, I realized that fully. They would overlook the fact that the force with which his head had been struck had driven it violently against the side of the cab, causing the injury to the back, and they did. When I got back there was an investigation. I was actually charged with hitting Hoskins in the head with a coal pick while going up Rockwood grade. No need to go into detail about the inquiry. Sufficient to say that the only thing that saved me was the testimony of the mail clerk, who swore that he had got no bag at the mail post near Rockwood, showing that it had been knocked off by some obstruction before the mail car reached it. Even then, so strong was the tide of opinion against me, that they said I had hooked the bag off with the poker first, to cause this deception. Of course, after being acquitted, I had to leave the service of that company, and the majority of the employés there to this day believe that I murdered Hoskins. All this because we didn't speak.

"So now, no matter how cranky a man may be that I fire for, I try to please him. I find it easier to pull old Burns' overalls off at the end of the run, to fill his pipe and put it in his mouth when I think that he wants it, than to walk around with the impression created that I am not on good terms with him. That is the story."

BOOK NOTICE.

"Mechanical Movements, Powers, Devices and Appliances." By Gardner D. Hiscox, M. E. Published by Norman W. Henley & Co., 132 Nassau street, New York. Price $3.

This is a book of about 400 pages, which are, approximately, 6 by 9 inches, and has 1,649 illustrations. There are twenty-eight sections devoted to various subjects, such as transmission and measurement of power, boilers, motive power, air power, gearing, etc., etc. The first section, on mechanical powers, is a compilation showing the lever, screw, inclined plane and wheel, together with some of their applications. Each is illustrated, and the formula for working out the problem is given. The book is in reality a dictionary, being almost too brief at times, and not paying attention enough to giving credit to sources of information. Several Haeseler air tools are shown without credit to the inventor, and Vanderbeek's universal joint is also shown, without a name to identify it from the rest. The idea of the book is good, and it will prove of value to many, both students and mechanics, as a source of information as to what has been done in various lines.

Solomon Snicker, Esq., of Stobo, informs the railroad man of *The Pittsburgh Post* that he has invented a patent pocket trolley which will enable any man to go from point to point in a big city without waiting for a car. The idea was suggested to him while he was hanging on to a strap on a Fifth avenue electric car recently riding to East Liberty. With Snicker's trolley a man can simply adjust the sprocket wheel to the wire, hang on to it by means of an insulated strap and go in any direction he desires to take. He wants the *Post* to illustrate his invention with a picture showing a long line of men and women sailing up Fifth avenue hanging on to straps. He claims that after his invention is adopted the electric lines will use straps instead of cars, and that it will be just as easy to hang on to the Snicker trolley and ride as to hang on to a strap in a crowded car.

Tremendous efforts seem to have been made to save the life of the favorite, Clifford, who murdered Mr. W. G. Watson, of the West Shore, several years ago. Clifford is at last sentenced to be hung on June 27th, but his lawyers intimate that they will have the case again before the Supreme Court.

Iron Made Red and White Hot in Water

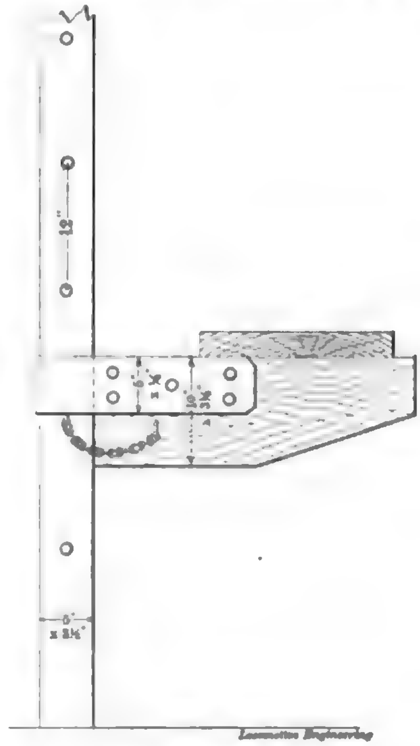
One of the astonishing things developed through the introduction of electricity into everyday affairs is a forge made for bench use for the heating of soldering irons or light pieces of metal for working on the anvil, where the heating is accomplished by plunging the article to be heated into a tray of water. Nothing could be imagined more contradictory of one's preconceived ideas than this procedure, and yet to the electrician it is perfectly simple.

He makes the proper connections, plunges his iron into the water, and pretty soon the iron will begin to glow under water, and then to turn red or white hot, just as he desires it for working. When he gets through working the iron he may plunge it into the water again and cool it with a "siss" as expeditiously as he could in any other tank of water. This curious forge is made as follows: The tank is of wood or of any other substance which will hold water and not form an electrical conductor. One wire of the electric circuit passes to the bottom of the tank, where it is connected to a plate of metal which lies there. Over this plate water, preferably saturated with salt, fills the tank nearly to the top and serves to conduct the current to whatever object is to be heated. Nothing could be better for this purpose, for the water naturally closes all about the object and fits it on every side. The other end of the current-conducting wire is fastened to the tongs or led to a metal framework at the edge of the tank on which the tongs or the shank of a soldering iron lie when it is to be heated. The moment the object to be heated is plunged into the water a current passes from the water through the object, and at the same moment some of the water is decomposed by electrolytic action. The nitrogen of the water becomes electrified and adheres to the object to be heated and forms a film of gas, which separates the object completely from the water, while at the same time this gas forms such an obstruction to the passage of the electric current that the energy of the current is turned into heat.

Electric forges of various designs are coming into use in place of fires for many of the blacksmith's operations. One of the new ones offered to the trade is arranged with one of its electrodes mounted at the end of an ordinary anvil, while the other electrode is swung above, where it can be drawn down by the pressure of a foot upon the pedal. The arm above has a wheel-like revolving head, and at the end of the spokes of this wheel are blocks of metal of various forms, adapted to fit the objects to be heated. The blacksmith turns down the form that suits his work, presses his foot on the pedal and watches until he has a proper heat, and then, releasing the arm, forges and finishes his work on the very anvil where it was heated. Such clever tools cannot, of course, take the place of the old bellows and fire for isolated shops, but in factories they are rapidly being introduced.—*St. Louis Post-Dispatch.*

Paint Shop Scaffold.

A scaffold for freight paint shops, and one that is cheap to get up, as well as a solid and safe structure for men to work on, is that shown in the accompanying cut. We saw the Michigan Central paint shop at West Detroit equipped with this scaffold and made the sketch of it as shown here. The uprights are made of pine, 3½ x 5 inches. The brackets are also of pine, 3½ x 5 inches, to which is riveted a piece of ¼ x 5-inch iron plate in the form of a U, which passes around the upright and serves as a guide for the bracket, on which rests the foundation plank. The upright has a series of holes ¾ inch in diameter for the supporting pin which carries the bracket. It looked so much like a good thing of its kind that we propose to hand it down to posterity.



PAINT-SHOP SCAFFOLD.

The advertising bureau that helps Mr. George H. Daniels, general passenger agent of the New York Central, seems to have been working overtime since the snows of winter melted. We have received so many folders and illustrated pamphlets setting forth the attractions of the Four-Track Railroad that the best we can do is to advise our readers to send for the whole of the Four Track series.

The Making of Books.

It is much easier to criticise than to avoid the cause for it, but it seems as though a little thought and care on the part of authors would add much to the value of their books.

One of the essentials is to tell where the information was obtained from, unless it happens to be original, and to state clearly where further data on this subject can be obtained. Kent's Pocket Book is a good example of this, and the giving of authorities quoted relieves the author from blame for errors, in case the authorities are of good repute, as nearly, if not all, seem to be in this case. Then the working out of a sample problem makes the application much clearer to any of us. Many of the engineering books show different kinds of engines, valves, etc., some of which have never gone beyond the experimental stage and are pronounced failures. To see these "freaks" placed in with successful devices and described as gravely as though they amounted to something is an injustice to the builder of the good ones and to the reader of the book. How is the student to know that the Fay valve is not all that is claimed for it, or that the Richardson balanced valve, shown possibly on the same page, is a thoroughly practical device, while the other is not. He looks to the book for information, and to the author as being able to impart it. But after he has learned through bitter experience that half the devices he saw illustrated with never a word of comment are not practical, he doesn't have the highest opinion of the author.

In justice to the reader who buys the book the author should discriminate between the successful devices and the failures by pointing out the weak spots and showing why they failed. As horrible examples of what to avoid, they are of value, but without some distinguishing mark they are misleading.

The Standard Pneumatic Tool Company will make an exhibit of their well-known pneumatic tools at the Convention. Mr. E. N. Hurley will be present to meet those interested, and will have samples of his "Little Giant" hammer, recently developed, which will be shown in operation. Railroad men operating compressed air shops will find that they can examine these tools with profit to themselves and their companies.

The Brotherhood of Locomotive Engineers is considerably interested in a suit brought against the St. Joseph & Grand Island by A. G. Roberts, an engineer, to recover $20,000 damages for being blacklisted. The plaintiff alleges that he was discharged and blacklisted because he refused to double over heavy grades for straight mileage. The defense is that his dismissal was for insubordination.

A Bursted Flue.

William Blue was an engineer in the employ of one of the trunk railway lines in Pennsylvania. One of his duties was to haul the through freight over the Western division, and his pet engine was No. 2. One night he had an accident. One of the flues in the boiler of his pet engine blew out and he was stalled, blocking the main line. He reported the matter to the division superintendent, unwittingly, as follows:

"Engine 2
Blew out a flue.
What'll I do?—
William Blue."

Then he sat down to wait for instructions. Twenty minutes later the superintendent's answer, as follows, was received:

"William Blue,
Plug that flue
On Engine 2
And pull her through.
Be careful, too,
Not to hold '22.' "

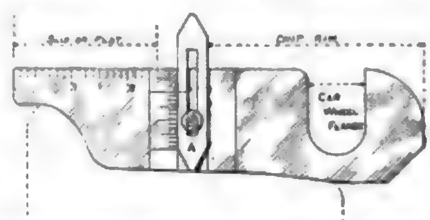
That is a yarn told by the *Post*, Pittsburg, Pa.; but it is not nearly true. The real telegram sent by the superintendent reads:

"William Blue,
You will never do
To pull a train through
On this road anew.
Anyone who knows boo
Would have plugged that flue
Without more adoo,
And brought the train through
Like the Royal Blue.
There's a time-check for you
And a discharge, too,
Which greatly you'll rue,
To begin life anew
In a strange engine crew."

The Shearer-Peters Paint Company, of Cincinnati, are pushing for business in railway circles, and seem to have a good thing. While their paint is adapted to almost every service, they make a "No. 2" which is especially made for locomotive stacks, furnace fronts, smoke and blast furnaces and any iron or wood work exposed to sulphurous gases. This is something that should interest master mechanics and roundhouse men.

In the report on a boiler explosion that happened lately in an English coal pit, the evidence proved that the feed water contained 6.17 grains of free sulphuric acid to the gallon. No boiler could boil that mixture very long without wearing out the sheets by corrosion.

The Lehigh Valley Railroad Company have issued a notice saying that it is the purpose of the company to withdraw four-wheel coal-car equipment from the trade and replace this tonnage with cars of 80,000 and 100,000 pounds capacity.



When a belt becomes badly oil soaked, and the pulleys have oil on them, it is well to sprinkle fuller's earth or prepared chalk on the belt. This will absorb the oil. Scrape off the residue with a piece of flat wood, slightly sharpened. A solution of salt on pulleys roughens the leather and helps to overcome some of the slip. Anything that acts as an unguent should be kept from a belt. If oil comes in contact with gum belts it softens them. If water gets between the canvas and the seams and then freezes, it separates the layers. Even a frosty pulley in contact with a gum belt tears the seams from the canvas. Boiled linseed oil lightly applied on the pulley side of a gum belt will help to overcome slipping, caused by dust, etc. Gum belts are now used with success in damp or wet places. They cannot be successfully used at half cross or on cone pulleys.

It is claimed by good authorities, and the statement is very likely correct, that the temperature attained by gas exploded in the cylinder of a gas engine is from 2000 to 3000 degrees Fahr., depending mainly upon the compression experienced by the gas before the explosion. It is because of such high heat that satisfactory lubrication of gas-engine cylinders has been impossible where oils alone have been used. Properly prepared flake graphite has successfully solved the problem. The Joseph Dixon Crucible Company, Jersey City, N. J., enjoy the work of lubricating cylinders with a temperature as high as a locomotive firebox on an up grade.

Business is brisk at the H. K. Porter Locomotive Works, of Pittsburgh, Pa. They have just received an order from the United States Government for heavy switching engines, to be used in the navy yard at Norfolk, Va. They have just shipped four compound locomotives to the Batoum district, Russia, and are now at work on four additional machines for Russia, and are building a small engine, of 24-inch gage, for use in the gold mines in Auckland, New Zealand.

We have received circulars from the Westinghouse Electric & Manufacturing Company concerning their direct-connected railway generators, Tesla polyphase induction motors, lightning arresters, as well as the timely and welcome electric fan. These are interesting to any mechanic and are arranged for ready reference by having holes perforated for filing in the form of a book.

The Standard Pneumatic Tool Company, who make the "Little Giant" hammers and other air tools, expect to have an interesting exhibit at Old Point Comfort. Members and visitors who attend the convention should not fail to see this.

A good stroke of advertising enterprise has been done by the Baltimore & Ohio Railroad people in connection with a ticket from Washington to San Francisco, purchased by Admiral Dewey when he was on his way to join the Pacific fleet. The ticket containing Dewey's signature, has been lithographed, and they are issuing fac-similes as souvenirs.

In a recent letter the Chicago Pneumatic Tool Company intimate that they received in one day by mail at the Chicago office orders for eighty-one pneumatic hammers and riveters, fifty-seven drills of different sizes and seventeen sundry tools, making a total of 155 orders. Another order was for eight pneumatic riveters for Shanghai, China.

They are building in the Pennsylvania Railroad shops at Altoona, Pa., a big engine with Wootten firebox which will be used for pulling the Atlantic City fast express train. We understand that the drivers of this engine are 87 inches diameter, and that the boiler will carry 210 pounds steam pressure.

There has been a reorganization of the H. K. Porter & Co., and it is now known as H. K. Porter Company. The officers are: H. K. Porter, president; W. E. Lincoln, vice-president; W. E. Martin, treasurer; C. L. McHenry, secretary; E. P. Lord, general manager and superintendent; D. E. Ferguson, purchasing agent.

Complete catalogue No. 10 has recently been issued by the Clayton Air-Compressor Works, New York. It is a very handsomely illustrated book containing a great deal of information about the purposes compressed air is used for and the great variety of appliances through which the air is converted into work.

The Atlantic Brass Company, of 192 Broadway, New York, are on the market with an adjustable car bearing which seems to have many good points of its own. They are pushing it on its merit solely, and are not depending on any trust to give them a share of its orders. This policy is the winning one in the long run.

The Chicago, Burlington & Quincy people have been making remarkably fast time with their new express trains. They claim a recorded speed of 90 miles an hour with a heavy train, and expect to reach 100 miles in the near future.

Mr. James Grey has been appointed road foreman of engines on the Santa Fé Pacific Railroad, with jurisdiction over Arizona division; headquarters at Albuquerque, N. M.

CONTENTS.

INDEX TO ADVERTISEMENTS.

Clean Locomotive Boilers

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The Hornish Mechanical Boiler Cleaner is always on duty. It keeps the boiler constantly clean.

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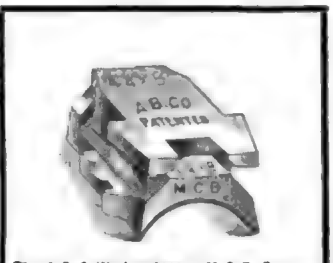
With contributions from more than one hundred prominent railway officials and inventors of special railway appliances.


The A.B.C. Adjustable Bearing Complete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Fits all M. C. B. Boxes and
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Prevents strains on wheels and rails. Permits the least friction under load, and enables engine to haul a greater tonnage.

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covers the axle flush to the square of its circle, and no more. Saves the extra wearing surface of 1½ by 7½ inches in the old M. C. B. bearing. This is not needed to carry the load and is simply a waste of metal, lubricants and motive power.

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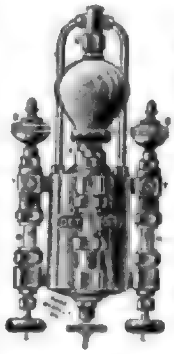

"Another remedy for the trouble is to connect a second pipe to the oil pipe at the top end, this second pipe to be supplied from dry pipe pressure."

So writes C. B. Conger, Associate Editor of "Locomotive Engineering," in his "Talks to the Boys," in the March issue. He is speaking of the difficulty of getting the oil to the cylinders against the back pressure, and describes our Tippett Attachment in the above extract. It will be noticed, too, that this is the only method he fully endorses.

The Detroit Lubricators with Tippett Attachment

deliver the oil to the cylinders as steadily as it rises through the glasses. They are the only lubricators that will do this. If you wish to be posted in regard to the latest developments in locomotive lubricators, send for our printed matter just issued, with explanatory drawings.

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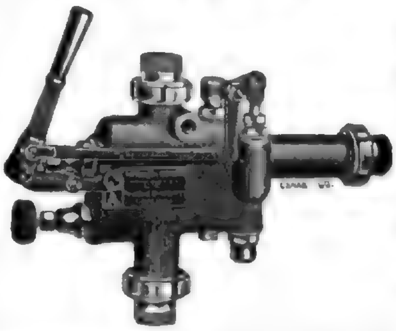
Absolutely no Adjustment..



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Special Pipe Fittings for Baker Heater Work.

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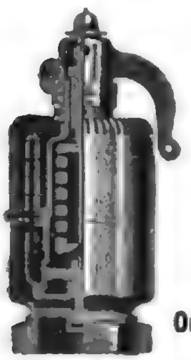

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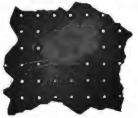

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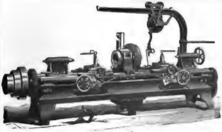

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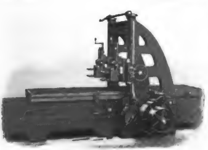

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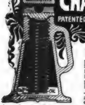

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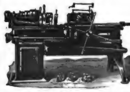

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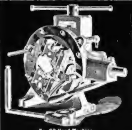

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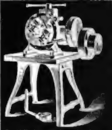

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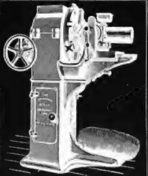

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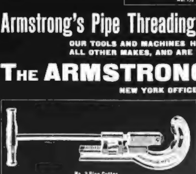

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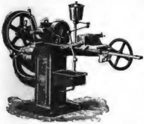

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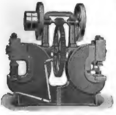

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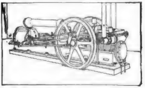

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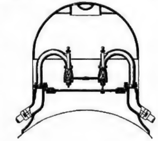

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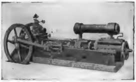

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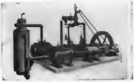

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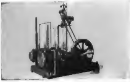

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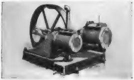

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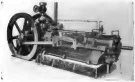

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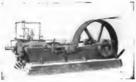

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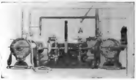

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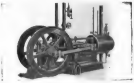

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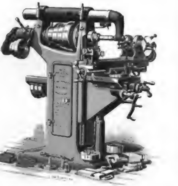

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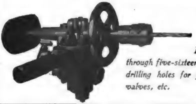

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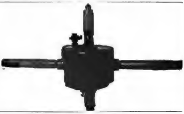

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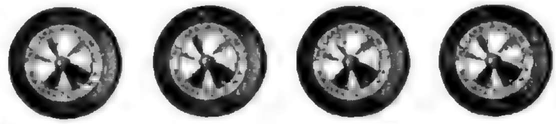

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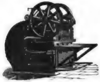

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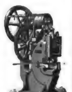

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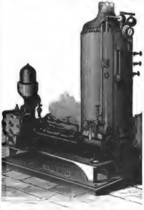

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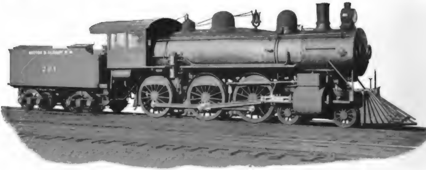

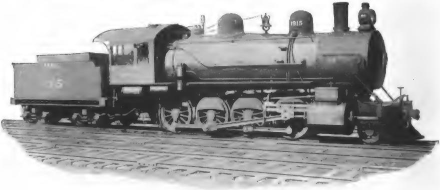
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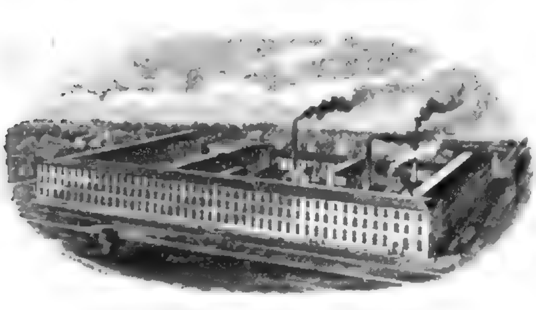

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Replying to a general demand for our machines, we wish to call your attention to our Radial Drills, which we build in sizes from 3 ft. to 14 ft. swing of arm We adapt them to every use.

We also wish to remind you of our Multiple Spindle Drills (which, by the way, is the greatest investment in a drilling machine you can make), which are built with from four to fourteen spindles and power for driving up to and including 1½ inch twist drills with diameter of circle up to 36 inches.

Our Boring Mills, of which we make three sizes, 37 inches, 51 inches and 61 inches, are strong, substantial, reliable machines. Everything is conveniently arranged for the operator, and the range of effectiveness is sufficient for all kinds of shop work.

The 16 inch Shaper is a "condensed planer," and will turn out the work quickly and accurately without jar or strain. It is unusually heavy and powerful, and altogether is an economical tool for any machine shop

Other machines are shown in our catalogue, a copy of which we will send you upon receipt of your office address. We are pleased to give prices and all desired information regarding our tools, and would like to hear from you at any time.

Yours respectfully,

BAUSH & HARRIS MACHINE TOOL CO.

W H Baush

Treas. & Gen'l Manager.

P. S.—File this leaf for reference. Our specialties are Drilling and Boring Machines.

(over)

The American Tool & Machine Co.

M. H. BARKER, Genl Manager
W. O. LINCOLN, Treasurer

109 BEACH STREET,

BOSTON, MASS.

June 1st, 1899.

To Master Mechanics, Shop Foremen and all Railway Mechanics:

Gentlemen:

We want to call your attention to the line of special Lathes we are making for R. R. shops, particularly our No. 2 Improved Turret Lathe and No. 1 Cabinet Turret Lathe, shown on the back of this letter sheet, with description, specifications and prices.

These machines are built for hard, accurate service and plenty of it, and if you will specify them in your requisitions you will not be disappointed in their performances, and will find you have procured the best value, everything considered, to be found in the market to-day.

We make other Brass and Iron Working machinery, such as a Square Arbor Lathe; Valve Milling Machines; Improved Turret Lathes; Plain Slide Rests; Compound Slide Rests; Box and Four-jawed Chucks and other specialties, which are fully described in our circulars. We also do a large business in Shafting, Hangers, Pulleys and Friction Clutches for power transmission. Kindly remove this letter and preserve for future reference and correspond with us when you are looking for the best made tools.

Yours very truly,

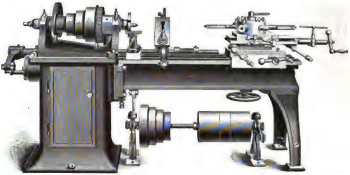
AMERICAN TOOL & MACHINE CO.

M. H. Barker, General Manager.

P. S.—We have been building high grade machinery for upwards of 50 years

(over)

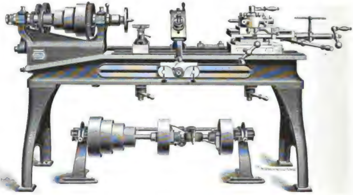
No. 1 Cabinet Turret Lathe.



Bed, 7 ft. long; swings 20 inches; Engine Feed, Back Geared, Screw Apparatus and Overhead Works. Cone for 2¾ inch belt, has 4 changes; Counter-Shaft with 12 inch Reverse pulleys, should make 60 revolutions per minute. Floor space 82 inches by 24 inches. Shipping Weight 2950 lbs.

PRICE, $875.00.

No. 2 Improved Turret Lathe.



Bed, 6 ft. long; swings 18 inches; Hollow Spindle, with 1⅛ inch hole; Back Gears, Screw Apparatus, Taper Attachments and Overhead Works.

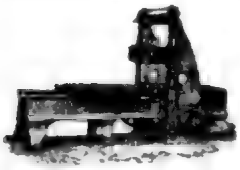
PRICE, $600.00.

H. B. HASKINS, PREST.
M. H. HARRINGTON, TREAS.
ROGER SHERRON, SECT.

CABLE ADDRESS "TOOLS"

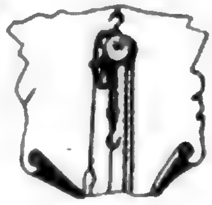
ATLANTIC CABLE
LEIBERS
A B C. } CODES.

SUPTS. { M. J. MORRISEY.
R. F. SCOTT.



Edwin Harrington, Son & Co.

INCORPORATED.



Machine Tools

N. Fifteenth St.
AND
Pennsylvania Ave.

Philadelphia, Pa., U.S.A. ....189...

To Master Mechanics and other Railway Officials:

Gentlemen:

We wish to call your attention to a few of our tools which are built especially for such work as yours.

The FACING LATHE, shown on the other side of this sheet, is used largely for packing-rings, cylinder heads and covers and similar work, which is not easy to handle rapidly on the regular lathe.

Our ROCKER SHAFT LATHE has all the features of a 48 inch lathe, excepting geared face plate, which allows it to be used for regular work. The reversing movement for rocker shafts is very simple and efficient. It's a money saver.

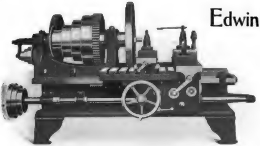
The new RADIAL DRILLS are meeting with a warm reception, and our regular line of lathes, drilling machinery of all kinds, planers, pipe cutters and straighteners, etc.

Harrington hoists and over-head tramways are among the absolute necessities for handling materials in any shape.

Better remove and file this after you have sent for a catalog and latest circulars. It will pay you to specify our tools and appliances in your requisition.

We solicit correspondence and will be glad to send photos and specifications of any of our Locomotive and R. R. Shop Tools.

Edwin Harrington, Son & Co., Inc.,
M. H. Harrington
TREAS.



Edwin Harrington, Son & Co.

Philadelphia.

Better send for Complete Catalog.

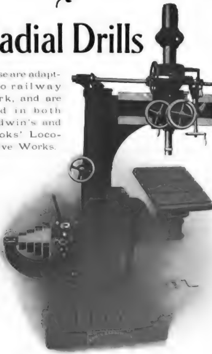
The Improved
Harrington Hoist.

"The Standard Hoist of the World."

THIS is used by such builders as the Baldwin Locomotive Works to face cylinder heads, turn packing rings, etc.

It's a tool to save money with.

Radial Drills

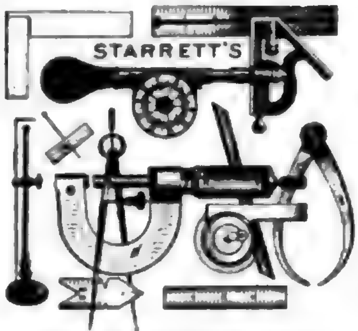


These are adapted to railway work, and are used in both Baldwin's and Brooks' Locomotive Works.

Load is carried on two distinct chains, each link having a greater strength than rated capacity of hoist. Has been greatly improved and will outwear any hoist made.

Made in Sizes from 500 to 20,000 lbs.

We make this drill in two sizes—48 and 60 inch. They have long bearings, large ribbed columns, broad base, and are modern in every respect.



New York Office, 128 Liberty St.

The L. S. Starrett Co.

Manufacturers of FINE MECHANICAL TOOLS

Athol, Mass., U.S.A.

Address all Communications to the Company

Cable Address STARRETT, ATHOL Lieber's Code Used.

June 1st, 1899.

To All Mechanics,

Everywhere,

Gentlemen:—You may not be aware that we make Hack Saws. We do. We make good ones.

They are made of the finest grade of steel. The teeth are sharp, with square cutting points, and evenly set. They are tempered by our improved process, which leaves them hard and tough, so that they will not ''shell off.'' They are too hard to file. The set of the teeth is just enough to insure a free, smooth and rapid cut, removing no more stock than is necessary.

Saws for common use have 15 teeth to the inch, except the 12 in., 14 in., and 16 in., which have 13 teeth. Those for tubing and bicycle work have 24 teeth to the inch. These are made in all sizes. Saws with extra fine teeth, 30 to the inch, are made in 8 in. and 9 in. sizes only. Other lengths to order in quantities.

The 6 in., 7 in. and 8 in. saws are 7/16 in. wide; the 9 in., 10 in. and 11 in. are 1/2 in. wide, the 12 in., 14 in. and 16 in. are 5/8 in. wide; the 12 in. with fine teeth are 1/2 in. wide.

We are confident these saws will satisfy you. Be sure this mark is on the saws and labels.

Please send for our Catalogue of Fine Mechanical Tools and Cutters.

Yours truly,

THE L. S. STARRETT CO.,

By L. S. Starrett

(Over)


THE L.S. STARRETT CO.
ATHOL, MASS. U.S.A.
L.S. STARRETT CO. ATHOL MASS.

Ott. Mergenthaler & Co.

Mechanical Engineers and Machinists.

COR. CLAGETT & ALLEN STS.
LOCUST POINT.

Printing Machinery, Machine Tools & Mech. Instruments.
Designs furnished for Special Machinery.

Baltimore, Md., U. S. A., June 1, 1899

To Master Mechanics, Shop Foremen and all Railway Mechanics.

Gentlemen:

We wish to call your attention to our combination Vertical and Horizontal Miller, a few strong points of which we have enumerated.

This machine will be found very useful in railroad shops, the vertical spindle making it specially adapted for that class of work. The machine is driven by a three-step cone of ample dimensions and is powerfully back-geared. The over-hanging arm is very stiff and is conveniently moved backward and forward by means of a worm and rack. The spindles each have 9 changes of speed, and there are 7 changes of feed for each spindle speed. The table has a quick return, and all handles are within easy reach of the operator. All wearing surfaces are ample and the machine is rigid and powerful, yet easily operated. Full description will be sent on application.

We also manufacture a full line of Adjustable Reamers and tube hole cutters.

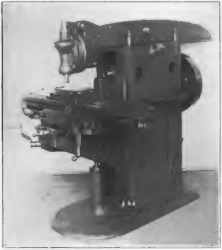
Yours very truly,

OTT. MERGENTHALER & CO.,

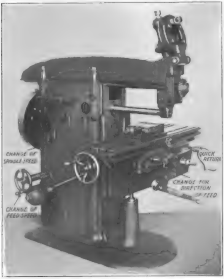
Baltimore, Md., U. S. A.

P. S.—Kindly remove this leaf for future reference.

Combination Vertical and Horizontal Miller.



VERTICAL SPINDLE IN WORKING POSITION.



VERTICAL SPINDLE THROWN OUT.

All the Features of Two Distinct Types Embodied in One Machine.

▲▲▲▲▲▲

Some of Its Strong Points:

Both vertical and horizontal spindles can be used jointly or independently.

Vertical spindle can be used in any position swung on an axis parallel to vertical spindle.

Any part of a piece of work can be surfaced or edged 40 in. from face of column and full length of lateral feed of table.

Change accomplished from vertical to horizontal, and vice versa, in less than one minute.

Feed mechanism has no belts, is positive, of wide range, and instantly reversed or changed from fine to coarse by lever motion.

Each spindle has nine speeds from a three step cone, and are strongly back-geared.

Three speeds to both spindles without shifting driving belt; change of speed accomplished by lever motion.

Hardened and ground journals on both vertical and horizontal spindle.

Other points, too numerous to mention; full description furnished on application.

▲▲▲▲▲▲

Ott. Mergenthaler & Co.

Baltimore, Md., U. S. A.

LONDON. HAMBURG CHICAGO.

The Standard Paint Company,

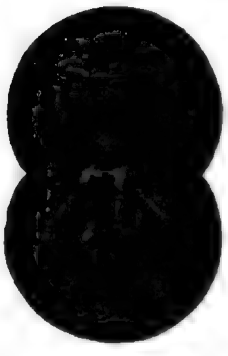
Manufacturers of

Preservative and Roof Paints,	P&B	*Ruberoid,*
Insulating Compounds,		*Ruberoid Roofing,*
Insulating and Sheathing Papers,		*Ruberoid Motor Cloth,*
Insulating Tape,		*Ruberoid Car Roofing,*

Armature and Field Coil Varnish.

CABLE ADDRESS "SCIATHERIC" LIEBER CODE.

81 & 83 John Street New York.



COLUMBIAN EXPOSITION CHICAGO, 1893.

TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION OMAHA, 1898.

INTERNATIONAL EXPOSITION TURIN, 1898.

HORS CONCOURS INTERNATIONAL EXPOSITION BRUSSELS, 1897.

TO RAILWAY OFFICIALS:

GENTLEMEN:

We take this method of presenting to you the merits of the best Car Roofing made. Owing to the insulating properties of our material, it is especially adapted for Refrigerator Cars. It is made from strong wool and hair felt thoroughly saturated with our water and acid proof composition, and will stand more of the rack, wear and tear of a car than anything made. It is just as well adapted for fruit, dairy, furniture and ordinary box cars as it is for refrigerators. It has also been found very valuable for flooring refrigerator cars.

For over ten years our P. & B. Insulating Papers have been the recognized standard for car work. We guarantee these products to be free from imitation rope, paper stock, ground wood, etc., and that our papers will not deteriorate with age. They are perfect con-conductors.

Please remember that we also make the best Paint in the market for coating floors of cars, parts of iron work, etc., about a car liable to rust and corrosion. Our Paint is very penetrating, absolutely water, acid and alkali proof.

P. & B. Locomotive Cab Roofing is far superior to tin for Cab Roofs, as it can never rust or corrode, is not easily cut, and is guaranteed proof against the action of locomotive fumes.

Ruberoid Roofing for general Railroad Buildings, such as round houses, train sheds, etc., is so well known there is no necessity to dwell at any length on its merits. Let us send you the names of some prominent railroads who are using it, with our sample book.

Our General Sales Agent, Mr. Frank S. De Ronde, as well as our Mr. Thomas Freeman, will be at the Hygeia Hotel, and will gladly answer any inquiries regarding P. & B. Products.

Yours very truly,

THE STANDARD PAINT COMPANY,

Ralph L. Shainwald

President.

We suggest you tear this out and keep it for reference.

ADDRESS ALL COMMUNICATIONS TO THE COMPANY.

P.&B. Ruberoid Car Roofing

will not Rack and Split.

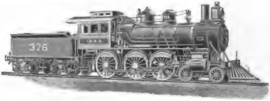
No Tar.

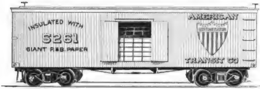
No Asphalt.

Will last the life of a car.

P. & B. LOCOMOTIVE CAB ROOFING.

Far superior to tin; can't rust; easier to apply. Strong; practically indestructible. Locomotive fumes, steam, gases, acids, etc., don't affect it. Send for samples.





P. & B. Insulating Papers.

Free from imitation rope or ground wood stock. Absolutely the best agents of insulation. Moisture proof, airtight and odorless. Guaranteed not to rot or decay.

Send for our latest Sample Book. . . . . .

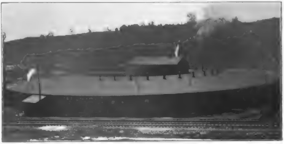
P. & B. Ruberoid Roofing.....

For Round Houses, Train Sheds, Repair Shops, Stations, etc.

Unaffected by locomotive fumes, gases, etc.

Absolutely waterproof.

Strong and very durable.



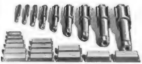
The Standard Paint Company,

MANUFACTURERS,

Chicago Office: 189 Fifth Avenue.
Hamburg: Grimm 33.
London: 39 Victoria St., S. W.
Paris: 50 Boulevard Haussmann.

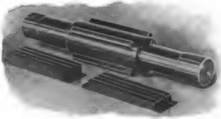
81 and 83 John Street, New York.

Nicholson's Expanding Mandrel



This set of Nine Mandrels will fit every hole from one inch to seven inches in diameter.

Will hold work for lathe, milling machine, grinder or any other tool firmly and accurately. No hunting over an old pile of solid mandrels for the right size. No truing up. These mandrels are true—ground after hardening. Special attention is paid to the centers in the arbors to insure best results. They are well protected from possible injury by driving because of the special shape of the ends of the arbors, which are nicely rounded from the center to the outer diameter. A set of these mandrels will last many years, save time, hold better and permit truer work than any other kind. Hundreds in the best shops of every kind in America and Europe. They say they cannot afford to do without them. Send for our new "Mandrel Book," free. Then you will say the same.



W. H. Nicholson and Company,

Makers of Machinery Specialties,

Wilkes-Barre, Pa., U. S. A.

SOLD BY

C. W. Burton, Griffiths & Co., London, England.
Hch. A. Eckstein, Berlin, Germany.

Acme Triple Bolt... Cutter

Designed for turning out a large quantity of work—all that a single operator can handle, and yet run machine at an economical speed—wear of dies and quality of work to be considered. They are the latest type of bolt cutters and worthy of a thorough investigation.

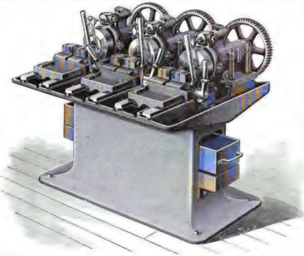
COMPACT.

EASY TO OPERATE.

LATEST "ACME" HEADS, EXTRA LONG DIE RINGS.

HARDENED TOOL-STEEL LININGS.

REMOVABLE CHIP-PAN.



LONG CARRIAGES. AMPLE BEARINGS.

DURABLE.

WILL DO ONE-THIRD MORE WORK THAN DOUBLE HEAD MACHINE.

DIES ADJUSTABLE WITHOUT STOPPING MACHINE.

ARRANGED TO RUN SINGLE, DOUBLE OR TRIPLE.

We also make
Acme Bolt Headers, Upsetting Machines, Forging Machines,
Nut Tappers, Bolt Pointers, etc., etc.

The Acme Machinery Co.,

CLEVELAND, OHIO, U. S. A.

Cable Address, "Acme." "Lieber's" and "A B C" Codes Used.

FOREIGN AGENTS:
Schuchardt & Schutte, Berlin, Brussels and Vienna; Adphe. Janssens, Paris;
C. W. Burton, Griffiths & Co., London.

The Janney Couplers.

THE ORIGINAL OF THE M. C. B. COUPLER.

ALTHOUGH the Janney is the oldest and most widely used coupler of the M. C. B. type, both for Passenger and Freight Service, it has not stood still. As new conditions of service have arisen the Manufacturers of the Janney Couplers have promptly met the new requirements. As railroad men probably read railroad advertisements more during Convention week than at any other time we wish particularly to call your attention to the merits of the

Buhoup 3-Stem Coupler for Passenger Cars.

It is unique among couplers, and when we advertised it as a novelty at the last Convention we could not foresee the great success it would be. It has a head pivoted at center and both sides to strong, spring controlled stems. It has three strong points of attachment to the car, giving treble strength, greater spring power and absolute relief to the platforms in curving. It forms the ideal coupler for vestibuled cars, private cars and all fast service trains. No special platform required. Price very low and service very high.

We have also been led by the increasing weight of freight cars to devise a simpler form of the above coupler, which we call the

Buhoup 3-Stem Coupler for Freight Cars.

It has all the advantages claimed for its prototype, the 3-stem for Passenger Cars, but is simpler and less expensive. For extra long freight cars, for 80,000 lb. and 100,000 lb. cars, it is the only safe and reliable coupler on the market, while in price it is low enough to meet existing demands for the greatest economies in railroad practice. It needs no alteration of existing timbering.

Illustrated charts showing application and details, can be had post free, on request, from

The McConway & Torley Co.,
Pittsburgh, Pa.

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Your Pipe Threading and Cutting

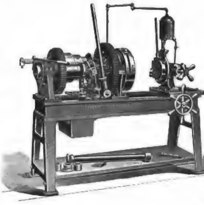
costs you too much money unless—it's done on the D. Saunders' Sons' improved machines. Take the 2A machine, for example: it threads and cuts pipe and nipples up to 2 inches, cuts off boiler flues up to 2 1-4 inches—does it rapidly and does it right.

The machine can run without stopping as long as one size of pipe is being handled.

Gripping chuck holds firmly and releases at will of operator.

This Die Head handles everything from ¼ to ¾ inch, inclusive. Easily and quickly adjusted and opens after thread is cut for pipe to be withdrawn. No stopping of machine

A new Nipple Chuck holds right or left hand nipples. Works without stopping machine. A money saver that will be appreciated.



A new Cutting-off Device uses two tools at once. Makes a better job, saves half the time.

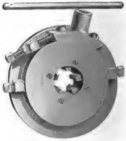
A Die Block for each size insures the correct setting of dies every time.

NEW CATALOGUE IS READY. WE'D LIKE TO SEND YOU ONE,

THEN YOU'LL SPECIFY TOOL MADE BY

D. SAUNDERS' SONS,

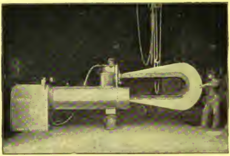
YONKERS, N. Y., U. S. A.



This Die is complete for each size. Lever controls opening for withdrawal and closing to size. 1, 1¼, 1½ and 2 inch heads with this machine.

Pneumatic Hammers,
Piston Air Drills,
Pneumatic Riveters,

Casting Cleaners,
Air Hoists,
Compressors.



THE MOST
COMPLETE LINE OF

LABOR-SAVING
PNEUMATIC
APPLIANCES

IN THE
MARKET.

UNRIVALED IN

SIMPLICITY,
DURABILITY,
EASE OF
OPERATION
AND ECONOMY
IN CONSUMPTION
OF AIR.

ALL TOOLS GUARANTEED ONE YEAR AGAINST REPAIRS AND SENT ON TEN DAYS' TRIAL SUBJECT TO APPROVAL.

Chicago Pneumatic Tool Co.

634-5-6-7-8
Monadnock Block,
CHICAGO.

1005-6 Beard Bldg.,
NEW YORK.

LocomotiveEngineering

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XII 95 Liberty Street, New York, July, 1899 No. 7

Schenectady Midland Engines.

The annexed illustration gives a good idea of the now famous mogul engines built by the Schenectady Locomotive Works for the Midland Railway of England. In our June issue we illustrated one of the engines built for the same road by the Baldwin Locomotive Works. A comparison of the two pictures will show that the builders must have enjoyed considerable latitude in the finish and minor parts. The Schenectady people have done their best to give the engines an English look, all the outside rivets being countersunk and chipped smooth; the sand boxes are placed under the running board and a six-wheel tender being employed.

The engines weigh 107,000 pounds, of which 89,000 pounds are on the driving wheels. The cylinders are 18 x 24 inches, and the driving wheels are 60 inches diameter. Figured by the usual formula, the engine develops 129 pounds at the drawbar per pound of cylinder pressure. The principal dimensions are:

Wheel-base, driving—15 feet 6 inches.

Wheel-base, rigid—15 feet 6 inches.

Wheel-base, total—23 feet.

Horizontal thickness of piston—5¼ inches.

Diameter of piston rod—2¾ inches.

Kind of piston packing—Cast iron.

Kind of piston rod packing—United Kingdom.

Size of steam ports—16 x 1½ inches.

Size of exhaust ports—16 x 3 inches.

Size of bridges—1⅛ inches.

Kind of slide valves—Allen-American.

Greatest travel of slide valves—5 inches.

Outside lap of slide valves—1 inch.

Diameter of driving wheels outside of tire—60 inches.

Material of driving-wheel centers—Cast steel.

Tire held by—Lip, and ⅞-inch screws between all spokes.

Driving-box material—Cast steel.

Diameter and length of driving journals—7½ x 8 inches.

Diameter and length of main crank pin journals—5 x 5 inches.

Diameter and length of side rod crank pin journals—Front, 4½ x 3 inches; back, 4½ x 4 inches.

Engine truck, kind—Two-wheel swing bolster.

Engine truck journals—5½ x 9 inches.

Diameter of engine truck wheels—36 inches.

Kind of engine truck wheels—Cast steel spoke.

BOILER.

Style—Extended wagon top.

Outside diameter of first ring—54⅛ inches.

Working pressure—160 pounds.

Material of barrel and outside of firebox—Worth "Basic" steel.

Thickness of plates in barrel and outside of firebox—⅝ inch, 9-16 inch, ½ inch, ¾ inch.

Horizontal seams—Butt joint sextuple riveted, with welt strips inside and outside.

Circumferential seams—Double riveted.

Firebox, length—72 inches.

Firebox, width—31¾ inches.

Firebox depth—74½ inches.

Firebox, material—Copper.

Firebox plates, thickness—Sides, ½ inch; back, ½ inch; crown, ½ inch; tube sheet, ½ and ¾ inch.

Firebox, water space—Front, 4 inches; sides, 3 inches; back, 3 inches.

Firebox, crown staying—Crown bars, 5 x ¾ inch, welded at ends.

Firebox staybolts—Copper, 1 inch diameter, 11 threads.

Tubes, material—Copper.

Tubes, number of—244.

Tubes, diameter—1⅝ inches.

Tubes, length over tube sheets—11 feet.

Firebrick—Supported on studs.

Heating surface, tubes—1,128.8 square feet.

SCHENECTADY MOGUL FOR MIDLAND RAILWAY, ENGLAND

Heating surface, firebox—126.46 square feet.

Heating surface, total—1,255.33 square feet.

Grate surface—15.87 square feet.

TENDER.

Weight, empty—43,800 pounds.

Wheels, number of—Six.

Wheels, diameter—50¾ inches.

Journals, diameter and length—5½ x 9 inches.

Wheel-base—12 feet 3 inches.

Tender frame—Steel plate.

Tender trucks—Wheels on axles in pedestal boxes.

Water capacity—3,250 imperial gallons.

Coal capacity—6 tons (2,240 pounds).

Total wheel-base of engine and tender—43 feet.

Engine equipped with combined steam and vacuum brake, Midland Railway standard; two 2½-inch consolidated safety valves; K. & M. magnesia lagging on boiler and cylinders.

At the recent meeting of the American Society of Mechanical Engineers at Washington, Mr. Charles J. Porter, the celebrated mechanical engineer, gave Mr. M. N. Forney the credit of having introduced the Allen valve into this country. In a letter written to the *Railroad Gazette* Mr. Forney says that all he did to introduce the valve was to write in its favor, and that Mr. James N. Boon, the well-known master mechanic, was the first to equip a locomotive with that form of valve.

The Horwich Shops of the Lancashire & Yorkshire Railway—III.

BY F. J. MILLER IN *American Machinist.*

(Continued from May Number.)

Fig. 23 shows a form of steam hammer which so far as I know is not found in America. And it is at once obvious that it has advantages where there is likely to be trouble with the foundations for a vertical hammer or from the vibrations caused by it, or where head room is not available. I do not know that any of these considerations had influence in the choice of this particular machine, but I do know that the man who stands at the levers shown in front of it has complete control of the machine with a good and

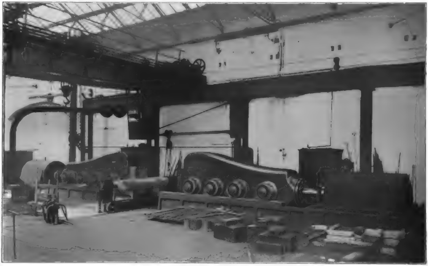


FIG. 23. DUPLEX HORIZONTAL STEAM HAMMER

clear view of his work, and that when the two heavy hammers meet in the center, one each side of the work and each one resisting and absorbing the force of the equal blow delivered by the other, very effective work is done with very little fuss. It is rated as a 35-ton hammer, by which I suppose is meant that both the hammers and their pistons together weigh 35 tons.

Fig. 24 shows the method of riveting frames by a hydraulic riveter, and the latter is supported by what is called a "giraffe crane," which, as clearly shown, is constructed to run along the shop on a broad gage track and with an arch, which thus passes over anything which may be on the standard gage track—such as the driving wheels shown in the engraving, for instance.

At Fig. 25 is a view in the erecting and repairing shop. Four overhead traveling cranes are in view, each electrically driven and of 30 tons capacity.

At the left of Fig. 26, which is a view of the erecting shop, a locomotive is seen suspended from two of the electric cranes and at the right there is an imposing array of vises. These do not, however, indicate that a proportionately great amount of vise work is done on the engines, but they are placed thus close together throughout the length of the shop so that a man working on any portion of the floor will never have far to go to reach a vise in case he needs to use one.

Fig. 27 is a view of one bay of the machine shop, in the left foreground of which are seen the vertical spindle milling machines for finishing rods and at the right the special machines for cylinders. Down the center runs the single rail upon which is supported the "walking crane," which is rope driven and is used in transporting material from one machine to another. These cranes were shown also in the sectional view, Fig. 10. On each side of this crane rail are the gratings before referred to, under which are the steam pipes for heating. There are three of these bays 508 feet long and with a combined width of 111 feet. At the top can be seen the white disks by which the light from the arc lamps is diffused and the formation of deep shadows avoided.

Figs. 28 and 29 show the narrow gage railway before referred to in operation.

the first of these being a train of "tipping wagons" and the other a boiler mounted on trucks especially designed for the purpose. This road, as previously stated, is supplementary to the one of standard gage. It is 18-inch gage and 6½ miles long.

Plain Talks to the Boys.

C. B. CONGER.

So you would like a talk about hot crank pins to-day? Well, as we see some roundhouse repair men in our audience, that will be a good subject for discussion.

It is a matter on which there is a wide difference of opinion, and some good arguments can be advanced on both sides. There have always been hot pins ever since engines began to turn, and we will never be entirely free of them; but some of the causes of hot pins do not receive proper attention.

One of the prime causes is insufficient bearing of the brass on the pin, which may be on account of the pin being too small in the first place. As only about 120 degrees of the whole surface of the pin takes the strain of the brass at one time, you can see that the number of pounds pressure per inch of surface is greatly in excess of any other revolving bearing about a locomotive.

A crank pin 5 inches in diameter is about 15¾ inches in circumference. One-third of that, or 120 degrees of the whole, will be 5¼ inches. It has become common practice to drop the circumference entirely and call the effective bearing equal to the "projected area" of the pin. This has been explained several times in the past few years and is equal to the diameter of the pin multiplied by its length. If a pin was sawed in two lengthwise, the surface, within the length of

FIG. 24. HYDRAULIC RIVETER FOR FRAMES.

FIG. 25. INTERIOR OF ERECTING AND REPAIRING SHOP.

the bearing part of the pin would be the projected area and would be diameter multiplied by length. So we drop fractions, and if the pin is 5 inches long, exclusive of the fillets, we will have 25 square inches for the bearing on the pin. If the working pressure is 180 pounds per inch on an 18-inch piston, we will have very close to 45,000 pounds carried by the main rod to the pin, which will be very near to 1,800 pounds per square inch of surface. If we compare this with the strain on a 4¼ x 8-inch journal under a car weighing 90,000 pounds it is a little over five times as much on the pin as on the journal.

Do you wonder that they run hot once in a while?

The crank pin, however, has one advantage over the truck journal. The strain changes from one side of the brass to the other when working, so that when one side gets all the strain the other side has a chance to get a good oiling, ready for its turn at the work; that is, provided oil enough is used to do this.

A bearing revolving steadily under such a load, as is the case with the truck journal, would squeeze all the oil out from between the bearing surfaces and get hot in short order.

Another cause for an insufficient bearing of the brass on the pin may be that it has been filed or scraped out when fitted up so that only a small part of the brass is in contact with the pin. This is wrong, and will give trouble until the brass is worn down to a good bearing again. Then the brass may be cut so it reduces the bearing surface, or the pin may be worn out of round and with ridges on it so that it does not present a good surface to the brass.

Where the brass is uneven and with too small a bearing surface on the pin it can be helped by tinning it over. This will fill up the hollows in the bearing, and as the soft tin on the high spots wears down quickly, it will soon have an even surface all over and run cool.

The material used for pins and brasses has something to do with cool running pins, and we may cite a familiar case to most engineers. A pin on one side of the engine that runs cool for long periods without having anything but proper lubrication, while on the other side its mate needs reducing once a month or oftener, and is hot at times with the best of care. Valve oil, graphite, special feeders that will ensure a liberal supply of oil are all tried on it, and finally when the pin gets cut so badly that a new one is put in with a set of new brasses the trouble ceases at once. In such a case it does not look reasonable that the trouble is all with the men in charge.

At the same time we are commending a good bearing surface on the brass we often find a brass that has the strips of babbitt in its face melted out and the recesses filled with sole leather or asbestos board, and run cool. Possibly the manner in which the strip of leather or asbestos helps to lubricate the pin has something to do with this good work.

The way in which the brasses are fitted to the pin when they are worn and need reducing has something to do with this question. If the pin was running cool previous to the report on work book—"brass to be reduced"—it certainly ought to run cool afterward; but this is not always the case. It is customary "to ease off at the top and bottom so the brasses will not pinch the pin if they get warm." Too much of this easing off process spoils the fine surface. If too much is taken off the edge of brass next the oil hole, so the strain of keying up comes on the ears at each side of the brass outside the strap, they will surely spring it out of shape when the brass is worn thin.

A wedge the full width of strap is better than a narrow key for keying up, especially if the brass is thin. If there is room between the key and brass for a thick steel

FIG. 26. INTERIOR OF ERECTING SHOP.

liner it will help the brass to retain its shape where a narrow key is used.

Except for the need of slacking off the brasses on the pin in case it begins to run warm, it would be good practice to line up the brasses tight in the strap and dispense with the key.

If the strap is separate from the rod so it can be done, put the brasses on the pin in the strap and key them up just tight enough so that they can be turned around the pin easily and have the proper amount of side motion as well. Then mark the key at the edge of the strap. When it is put on the rod and ready to go to work, you will have a certain mark to key up to. With a forked end rod this cannot be done.

Any main rod should have a little lateral motion at each end, at every point of the revolution of the wheel. To try this, pinch the engine over to different points or try her outside the house before coupling on the train, and see that it is not binding anywhere. If the crosshead pin or brasses are the least bit out of truth and keyed up tight, it will affect the work of the crank pin end very seriously. There should be sufficient lateral motion at the crosshead end to allow the other end to run freely and without binding at any point in the revolution.

When the engine is rocking around on rough track or passing around sharp curves, the crank pins and crosshead pins are not in line. The rod must either have some lateral motion or spring out of shape to meet the new lines.

Crank pins that are sprung will cause hot bearings. Sometimes you will notice that they wear at alternate ends on opposite sides of the same pin; have them tested before the trouble begins to hurt. If you think a crank pin is out of round, have it carefully calipered.

A crosshead pin that is out of round does not give as much trouble as a defective crank pin.

Each time you fill the rod cups or start out on a trip, unless you know they have been examined, see that they are in good order. If of the plunger type, lift them up and turn them around so as to be sure that they are free to move. This will also put a little oil down on the pin to start off on. If of the taper needle type, drop a little oil down the tube and note if it comes out along the edge of the brass when you screw the oil cup cover down. Where a brass cup is screwed into the strap or rod, remember that if too much force is used when screwing the cup on the strap or the cover on the cup, that it will twist the screw plug at the bottom of the cup. This will change the shape of the hole through this plug so the feeder will not move up and down freely and do the work we expect of it.

One of the great advantages of an oil cup that is forged solid on a rod or strap is that the shape of the hole does not change, except with wear, as the cup is iron or something as hard and has a long bearing. A plunger will not wear it out of truth as quickly as in a brass cup, and they don't come unscrewed or break off. You can screw the cover down tight without twisting the cup off.

Strain your oil, and be careful and use nothing but clean material for lubrication. A very small particle of grit will get next to a plunger feeder and make it stick, where a larger particle would not work down. A short thread of waste can wind around a needle feeder at the point and stop the oil from passing down, so the bearing will get hot. When you take off the cover, the guilty thread will drop off somewhere, maybe down into the cup, and be ready for another stoppage.

A good many crank pins are lubricated with a thick grease, fed through a cup made specially for the purpose. Most of them run a little warm at all times, so the grease will feed around the bearing; but what little grease does feed down stays on the bearing, and is not thrown out by the centrifugal force at high speeds. This takes less of the lubricant, and does not

FIG. 27. A BAY OF THE MACHINE SHOP.

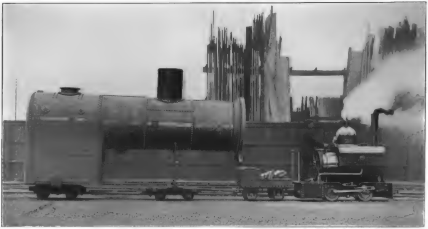


FIG. 28. VIEW OF THE NARROW GAGE RAILWAY IN THE WORKS.

allow dirt to work in at the collars of the pin next the brass, as the thick grease in a manner covers this opening.

A very little oil, if it stays on the bearing, will do the work; but it should be of a proper consistency, so it will feed down at all times. Valve oil used where the temperature changes from hot to cold, is sure to cause hot pins. It will not feed down when cold till too late to prevent damage.

Why does a thick grease work under those conditions, you ask?

Because it is used in a special cup, which forces a supply down on the pin, and it stays there till used up while oil is expected to feed down as a fluid. A change of temperature changes the rate of feed; so that on a hot day the oil splashes all over; the next day it may not feed enough for running cool, and the pin is hot before the oil in the cup gets thin. Look out for this with thick oil.

It is stated by those who use it, that the pin and brass wear faster with a grease than with engine oil.

A great many of the railroads in the West are taking the platforms off their baggage cars. When this change has been made the trainmen call them "muley" cars.

FIG. 29. ANOTHER VIEW OF NARROW GAGE RAILWAY.

Adventures of an Engineer in Tropical America.

BY W. D. HOLLAND.

SECOND LETTER.

I believe I left my friends in the last issue on a boat in the Panama Bay, returning from dinner on the "City of New York." I had two Jamaica niggers at the oars, and they did not seem to be in a hurry to get me ashore, which aroused my suspicion. A nigger and a Spaniard are two nations that I never come in contact with without a dagger, and whenever I have to deal with them I grease my .44 gun. It is dangerous in those countries to turn a sharp corner at night without having your hand on the trigger. So in this case I was also prepared to kill two negroes in case of emergency. I told them to hurry and take me ashore before the tide would go out, but they only played off, and I saw in a moment that they tried to keep me back. I told them to hand me the oar and I could row and steer the vessel ashore myself, or if they got me stuck here I would kill them instantly. Negroes always carry knives, but very seldom a gun; so in a moment I pulled my .44 revolver and fired seaward, threatening to make them food for the fish if they tried any humbug. This hint did its work, and they swiftly made for the shore, where we finally landed about five hours after I left the steamer. I shall never forget that dark and windy night on the bay of Panama, and I thanked God for my safe arrival. I paid the negroes, went to my hotel and made a vow never to attempt to take another trip at night under the same conditions.

LOCOMOTIVE HOUSE, POINT BARRIOS.

Two days later found me aboard the "City of New York" and off to Salvador. The captain and chief engineer, on hearing of my adventure, told me they had felt worried to see me go and warned me against similar trips. We stopped several times along the west coast at San José and Corinta. At the next stop I was to leave the good "City of New York" and present my letters to the managers of the Consul General. A day or so before we arrived in Acajutla we struck heavy seas, and when we arrived the vessel rolled and pitched so as to make it an impossibility to unload the mail. After several vain attempts Captain Johnson and Chief Engineer Hirleigh told me to let Salvador go and come back to God's country with them, which, under the circumstances, I was compelled to do. So fifteen days later we passed through the Golden Gate and pushed alongside the Pacific Mail wharf in San Francisco, the best town in the Union, where I had left only ten weeks before for New York and South America. So back again I was, and I felt lost, or, as we say in South America, "I was off my eggs." Thus, after a visit to Golden Gate Park and a two nights' rest at the Palace Hotel I thought of calling on my old friend, Master Mechanic McKenzie, but finally decided not to do so, as long as I was unsettled. I boarded the Sacramento train the following morning, but luck seemed to be against me, for nearing the State capitol our engine broke down. I walked ahead and saw my old friend Con. Collins, who had a spring hanger broken. We worked together, though on my part it was a labor of love and not of duty, as my duty with the Southern Pacific was ended several years ago. A few more days brought me to Tucson, Arizona, and here I met Mr. R. Gray, whom I had known in Oakland, where he was pulling passenger while I was night foreman. In Tucson, Gray was master mechanic and seemed glad to see me. After talking for a while I asked him for a job, and he said he was glad to put me to work. So I worked for Mr. Gray for six weeks, and during that time I earned a record, that is, I set the valves and keyed on the eccentrics in nine hours. I drilled and chipped the key seats, fitted the keys, completing the whole job. In six weeks I was off again, and when Mr. Gray asked me why I did not stay long enough to make a stake, I told him this stake would take me to where I could see the Southern cross. A couple of days later I was in New Orleans, and was undecided what to do. Some years ago I met Mr. H. A. Parker, then third vice-president of the Chicago, Rock Island & Pacific (now first vice-president), who gave me a letter to report at any time to Mr. George A. Wilson in Chicago for a position. In the meantime I took a trip to the Algiers shop. I walked up the track, and the first man I met was the famous Shorty McNight,

CAPITOL AT GUATEMALA.

who upon learning that I had no pass, told me to get out at once if I did not want to have the whole police force after me. He would see me at noon at the gate. I turned back and found myself surrounded by a dozen detectives and watchmen, who placed me under arrest. I got out after telling them I was ignorant of their rules and looking for a job. So they all took me to Mr. Nolan, who is master mechanic at present, I believe, and being a brilliant man he amply deserves that position. I told him I walked up the track and the detectives said they believed me to be a stockman. Mr. Nolan asked me what I could do and whether I had any tools, and I told him I was a first-class machinist. He wanted me to come around in the morning. I had no intention to work, however, and told Shorty McNight when I met him at noon that I would either go to Chicago or to South America. He insisted upon my going to work, and I decided to try my hand in the morning, which I never regretted, for both Mr. McConnell as master mechanic, and Mr. Nolan as general foreman proved good men and dear friends to me.

For one month I remained in Algiers, when at the theatre one night I met a man who asked me: "Mr. Holland, don't you know me?" At first I did not recognize him, but finally I found out he was an old friend, at one time United States Consul at San José, Guatemala. We were glad to meet and I told him I was pounding the hammer at Algiers. He said he was building a road in Central America, and I asked him for a position. He asked me if I could lay a track, and I answered him I could lay any track. (Those Central American people think a machinist can do anything.) At 2 o'clock that morning I had in my pocket a contract to lay steel for the Guatemala Northern at a salary of $175 gold per month. This was Sunday and Thursday I was to sail to Central America on the steamer "Stillwater." So I bade Mr. Nolan and Mr. McConnell good bye, and they regretted to see me go, and on Thursday I sailed down the beautiful Mississippi, little thinking that I would not see God's country again for four years.

CATHEDRAL AT GUATEMALA.

Old Point Comfort has again proved itself to be a most uncomfortable place for holding railroad conventions in the middle of June. The writer has attended conventions at that place five different years and every time bitter complaints were heard about the heat, the evil effects of water, shell fish or something else upon the internal economy of the people. This year all the old comforts were endured, with the additional misery that the heat and humidity were unusually enervating. Few people were well, many were prostrated and confined to bed, so that the complaints were unusually numerous, and the common cry was what did the executive committees mean by bringing us again to this miserable place? For several years the mechanical conventions have been swinging between Saratoga Springs and Old Point Comfort. The name popularly bestowed upon it this year was Old Point Discomfort. We suppose, however, that when two years roll over and the miseries endured at the 1899 convention become a reminiscence, the committee will again vote to subject those who attend these conventions to endure the tropical heat of the sand formed peninsula where Old Point Comfort is built.

The Newest Explosive.

The other day an engineer was proudly displaying a McVicar oil can, which he had just received as a premium for making extra good oil mileage, when a brakeman took it from him to explain how the concealed mechanism inside the can operated. He said: "You see that spring catch next to the handle is a windup for a time lock that goes to work as soon as he gets down off the deck to oil her up. If he is over three minutes doing it, it blows up and kills him. We are going to have all them kind of cans on this line right away. The train dispatcher is going to order five hundred of them."

The engineer let that explanation go, and kept on touching up the oil holes easy, and still got through oiling around before the can was due to explode.

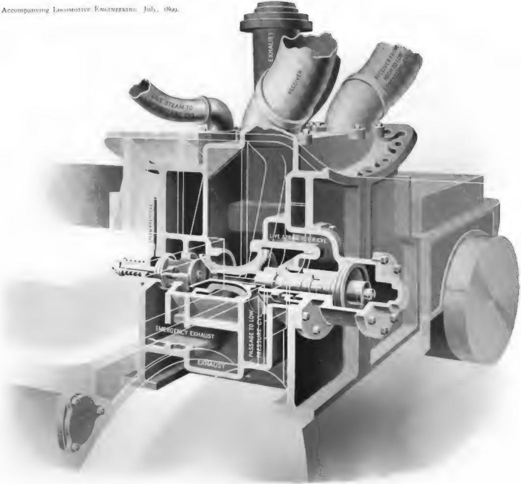
Refusing to Have Triple Valves Tested.

There was a rather edifying discussion at last Master Car Builders' Association on triple valves. Several years ago there was a standing committee of the association appointed to make tests of triple valves, and it was decided that certain requirements in the action of a triple valve should be complied with before it would be passed as a proper brake to use. The New York Air-Brake Company objected to the requirements as their brake would not meet one of the requirements, and consequently they declined to send triple valves to be tested. The New York Air-Brake Company also complained that they were not fairly represented in the Committee on Triple Valves.

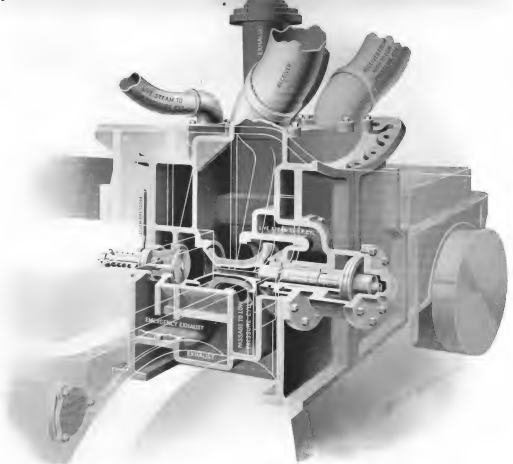
The association displayed a keen sense of fairness and justice by passing a resolution calling for the appointment to the committee of two members who are familiar with the working of the New York air brake.

The allegation has repeatedly been made that when a New York Air-Brake Company's triple valve is in a train and a service application made, the valve will act in such a way that all the Westinghouse air-brake triples behind it will produce emergency application. This may or may not be true; but so long as the New York Air-Brake Company refuse to send their triple valve to be tested by the Master Car Builders' Committee, it is fair to assume that the apparatus possesses the serious defect mentioned. Possessing that defect, that brake has no right to be mixed up in a train with other cars equipped with the Westinghouse air brake.

Last year the Chicago, Rock Island & Pacific Railway ran in passenger service 750,000 miles per hot box. That is a pretty long journey to find the smoking box of evil odor found so often on some lines. The recipe for the long journey mentions care, good lubricants properly applied, axle boxes that hold the oil and good bearing metal.



RICHMOND COMPOUND LOCOMOTIVE. INTERCEPTING VALVE IN SIMPLE POSITION



RICHMOND COMPOUND LOCOMOTIVE—INTERCEPTING VALVE IN COMPOUND POSITION.

General Correspondence.

All letters in this Department must have name of author attached.

Exhaust When Engine is Drifting.

In the January number of LOCOMOTIVE ENGINEERING Mr. J. F. Wallace asks, "Why is it that after an engine that is equipped with the American balanced valve is shut off, that a distinct exhaust can be heard by one standing near stack, and that at forty or fifty miles an hour it causes a draught that can be noticed in the firebox?"

To anyone the least familiar with the action of the valve on piston of an engine in motion, the following explanation ought to be sufficient. To those not so far advanced, a little investigation ought to make the matter clear to them.

Assuming that the engine is equipped with a relief valve on steam chest, we will start with piston at extreme forward end of cylinder; lever in full stroke position in the direction in which the engine is moving, and engine drifting. The valve is now in the position to open communication from the steam chest to the cylinder. As the piston moves back, the tendency is to produce a vacuum in the forward end of the cylinder and steam chest, but air rushing in through the relief valve prevents the formation of a vacuum. After the piston has moved, say, 21 inches, the valve, which, after moving in the same direction as the piston until the full port opening was given, has also reversed its motion, and at 21 inches travel of the piston has just covered the admission port, thereby cutting off the supply of air to the forward end of cylinder. During the remaining 3 inches of piston travel the valve has moved ahead far enough to open communication between the cylinder and the exhaust port. But no exhaust takes place, as the air in the cylinder is about atmospheric pressure—if any difference, slightly less, owing to the admission port being covered by the valve during part of the last 3 inches of the piston stroke, and the consequent tendency to produce a partial vacuum under such conditions. Now we have arrived at the point from which we accumulate the pressure that produces what seems to be an exhaust, but which in reality is only the forcing out through the exhaust passages during the forward stroke of the piston, the air that was drawn into forward end of cylinder during the back stroke of the piston. Directing our attention to the forward end of the cylinder only, we begin the forward stroke of piston. The exhaust is still open; and as the piston moves forward, it forces the air out through the exhaust. At high speed the air discharged in this way sounds very much like the exhaust of an engine working steam.

Bellevue, O. THOS. P. WHELAN.

Tonnage Rating and Fuel Records.

In your May issue appears an article with the caption "The Ton-Mile Per Hour." Having for years closely followed the question of tonnage rating and fuel records on a ton-mile basis, the writer was surprised to learn that the necessity exists for a better method of arriving at the individual coal record of engineers, for the reason that the majority of the points mentioned by Mr. Hodgins as essential to a proper comparison have, since August, 1894, been taken into consideration by the Chicago Great Western Railway, whose methods have since been explained to some fifty or sixty officials, representing an equal number of roads and, it is assumed, adopted by most of them. The Chicago Great Western method of working out the consumption of fuel on a ton-mile basis does not entail a very large amount of labor, and can best be explained by the following instructions, which were drawn up in order to meet the demand for information made on them by other roads:

HANDLING TRAINS ON TONNAGE BASIS.

The Basis.—The number of tons each class of engine is capable of handling, in each direction over all ruling grades of the main line, has been determined by actual tests of the locomotives.

The Rating.—The tests were made under the most favorable circumstances—i. e., favorable weather and dry rail—and the results so established were considered the maximum capacity of the engines and established as No. 1 rating.

To provide for inferior rail, unfavorable weather and stormy weather, No. 2 and No. 3 ratings were established, by actual tests and approximates; the result being that No. 2 rate averages about 90 per cent., and No. 3 rate averages about 80 per cent. of No. 1 rate.

Tonnage of Trains.—The weight, in tons, of each carload shipment, car and contents, is inserted in way-bill by agent. Fractions are not used. Less than 1,000 pounds is dropped; over 1,000 pounds counted 1 ton. This information is shown on "Switch List" used by yard men making up trains. The weight of empties, not generally moved on regular bills, is inserted on list, according to schedule of weights given on "Conductor's Report" form.

The weight of all cars and their contents being inserted on this report (conductor's report) it is certified to by agent. This information is sent to the dispatcher, and at all stations when cars are set out or picked up, the change in tonnage is also reported to him, the information being entered on his train sheet, thus enabling him to know at all times the exact tonnage engine is hauling. At stations where there are no track scales agents estimate the weight of carload contents in accordance with schedule of weights shown on back of form 875.

TO DETERMINE THE RATE TO BE HANDLED.

This matter is left to the discretion of the dispatcher. In the absence of instructions from him, No. 1 rate is to be used. To enable the dispatcher to determine the rating, he receives twice each day weather reports giving all necessary information as to weather and rail conditions. In event of defective engines, excess of empty cars, or other cause which would seem to justify a reduction in rating, the dispatcher will allow the engine to fall below the prevailing weather conditions, generally about 5 per cent.

Stock and time freight trains are allowed a reduction below the weather conditions, when behind schedule time.

Conductors, when unable to reach the dispatcher by wire, are allowed to reduce the rating of their trains, for cause, but must report the fact to the dispatcher immediately upon arrival at the next telegraph office.

COAL RECORDS ON A TON-MILE BASIS.

The Basis.—The basis or allowance of coal per ton-mile of total train has been determined by actual tests for each direction and class of train, by divisions. The class of locomotives and train, the character of road, etc., having been duly considered.

The Operation.—When an engine departs from a terminal the round house foreman delivers a coal slip (form 1,219) to the engineer, showing the number of tons of coal on the tender. If any coal is taken between terminals the engineer shows the amount on the slip, which is delivered to the roundhouse foreman at the end of the trip. In addition to this slip the foreman at departing terminal enters the number of tons on tender on form 1,224, and also shows the number of hours engine is under steam before departing on run, idle and switching.

The foreman at arriving terminal computes the number of tons on tender on arrival by means of marks on the side of the coal pit, which is entered on form 1,224, together with the information obtained from form 1,219, and the number of hours the engine is idle under steam or switching after arrival before coaling. This form is sent in daily to the master mechanic. In determining the net consumption while on the road or while running, an allowance is made for standing idle under steam and switching of 50 pounds per hour for the former and 500

pounds for the latter, the number of hours so spent on the road being taken from the conductor's delay report and at terminals from form 1,224.

From the amount of coal consumed while running, the number of tons of coal consumed per 10,000 ton-miles of total train is computed. The allowance or basis multiplied by the 10,000 ton-mileage of the train, including engine and caboose, gives the amount of coal that is considered should be consumed, or the amount "allowed." Form 1,229 is used in computing consumption of each train for one month, and forms 1,227 and 1,228 are used for showing the performance of the enginemen. Form 1,227 shows the cost of coal used for each 10,000 ton-miles by each engineer, and the coal in dollars and cents wasted by each, as compared with the last record shown on the same train or run. Form 1,228 shows the excess and percentage of excess in tons over the allowance.

The foregoing, I believe bears out my statement that the majority of the points mentioned by Mr. Hodgins have for years been taken care of, and it would therefore appear, to the writer at least, that the matter of fuel records is on a more satisfactory and fairer basis than is generally supposed.

Mr. Hodgins in his article ignores what is practically the most essential factor in arriving at comparative records of individual engineers, if it is desired to do so in a simple and fair manner. This is the basis or allowance of coal per ton-mile of total train. If this is determined by actual tests for each direction and class of train, by divisions; the class of locomotives, trains, etc., being duly considered; comparisons being made by divisions, and but one kind of coal, when practicable, used on each; the amount of coal dealt with as "used' being that actually used in running—i. e., the gross amount less that used in standing idle, switching, etc.—it is evident the records would be built on a solid foundation, and that we would not need the "per hour" to equalize them, and would, moreover, be able to compare men by divisions, irrespective of class.

The point raised by Mr. Hodgins, regarding the engineer who handles a certain tonnage in twenty minutes less time than the man on the first division, is well taken, in so far as it is a fact that to make up time additional coal must be used. On the other hand we might go further into the matter and say there is the engineer who endeavors to make up time, but fails through unforeseen causes. What credit would such a man receive under the "per hour" system? To the writer's mind, this is one of the things likely to happen to each and every man; and while not of great consequence, practically equalizes itself, provided the allowances are on a proper basis. One might argue that the passengers should be weighed in order to give the engineer hauling the most weight in passengers proper credit, or that the ton-mile should be reduced as the coal on tender decreases. The methods used on the Chicago Great Western Railway have stood the test of five years' practice, and have, in the light of experience, been improved from time to time. The writer therefore has no hesitation in recommending the system as one which will, with proper attention, obtain good results, and at the same time demonstrate to the men (unless they are looking for hairs to split) that their record is worked out on a fair basis—this without having to maintain a large force of clerks.

In conclusion will say, in my opinion officials make a mistake in surrounding these and similar records with mystery. If they would do a little missionary work among the men, explain the why and wherefore of the records, it would be found that less friction would arise, simply because the men would have a better idea of the conditions under which they were working.

Enclosed please find blanks used by the Chicago Great Western Railway, publication of which may help your readers to form a clearer idea of the matter, and may, in conjunction with the instructions embodied herein, enable those going into the matter to avoid the snags struck from time to time by the writer.

John H. Goodyear,
Buffalo & Susquehanna R. R.
Galeton, Pa.

[The blanks would take too much room for our pages. We would recommend anyone sufficiently interested to wish to study them to send to the Chicago Great Western, St. Paul, Minn., for copies.—Ed.]

Blocking Disabled Schenectady Compound.

In the May number, your answer to S. H. D., Missoula, regarding using high-pressure side of Schenectady two-cylinder compounds, when low side is disabled, the answer furnished by those people is correct. But there are some of their first make in use yet that were built without exhaust valves. The Southern Pacific Company put a valve in the front end for an exhaust valve. A great many times it sticks shut and cannot be opened. Bad water sediment burning on the disk causes that. Answer to S. H. D. should have read:

If it is required to use left or high side alone, exhaust valve must be opened. But if it cannot be opened, allow high-pressure exhaust to pass through receiver to low-pressure chest to exhaust port, etc. By uncovering, valve can be moved back far enough to do this. When this is done intercepting valve must be blocked back into compound position. C. R. Petrie.
Los Angeles, Cal.

Wear of Crank Pins.

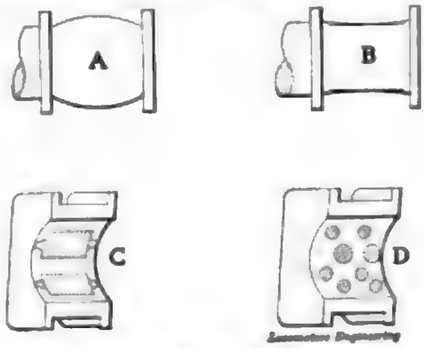
A friend sends me two sketches of crank pins which have come to his notice, one worn convex or rounding as at *A* and the other concave or hollow as at *B*.

The first he accounts for as being caused by sand getting into the sides of the box and wearing both pin and brass, which is a very reasonable supposition. The concave bearing he is unable to account for.

It is usually the case where brasses are lined with babbitt that this does not extend quite to the ends of the box. In such cases it is not uncommon to find the pins worn hollow in the center or else the whole middle being worn down and ridges left at each end. This depends on the shape and size of the babbitt somewhat, as it holds grit more than brass and acts as a grinding lap.

With the babbitt in the shape shown at *C* it is quite apt to wear a pin hollow, as the most grit will be held in the center, unless on a very sandy road enough more gets in at the sides to counteract this.

Way back in 1864 and 1865 the Dickson people used to bore holes in the brasses and fill with babbitt, something as shown



WEAR OF CRANK PINS.

at *D*. Care was taken that the spots overlapped, but they usually wore ridges to some extent, owing to the different amount of the babbitt in contact.

I. B. Rich.
Honeybrook, Pa.

Those Creeping Rails.

I have read your article in June number of Locomotive Engineering regarding "Creeping Rails on Eads Bridge," and as you solicit explanations, I beg to offer the following.

If the creeping is in the direction of the traffic over the rails, I would suppose it to be caused by the heavy trains rushing out of the tunnel, and just before reaching the Washington Avenue Station suddenly throwing on the air brakes with such force as to slide the wheels, which no doubt must grip the track and shove the rails along, or act as a battering ram, to a certain extent. If the creeping is not in the direction of the traffic, I can offer no explanation.

J. H. Siegrist, Jr.
St. Louis, Mo.

Paint Burner.

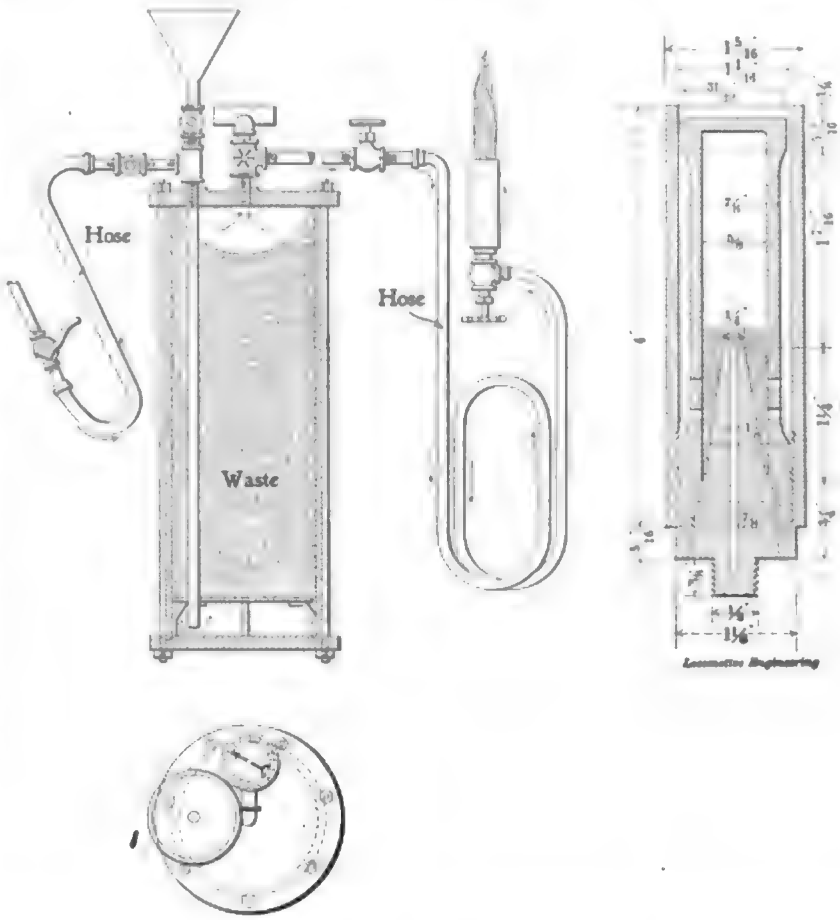
The annexed illustration shows a very successful form of paint burner which is used by the Southern Railway. The reservoir is 36 inches long by 12 inches in diameter. It is completely filled with clean waste packed as tightly as possible. The reservoir has a false-bottom and top, both of which are perforated. The air pipe extends into the space between the false and true bottom, and the air becomes thoroughly saturated with gasoline, with which the waste is saturated, before it reaches the corresponding space at the top into which the discharge pipe enters. An interesting feature here is the use of a pressure gage upon the discharge pipe. and a valve at this point for controlling the supply.

The burner is of peculiar construction and is designed with a view to still further mingle the air and gasoline. The supply enters the burner through a nipple, having an aperture 1/8 inch in diameter. This nipple is enclosed in a cap, having its outer extremity closed but with a series of perforations below the tip of the nipple. There are 35 of these perforations, 1/8 inch in diameter, in four rows staggered. The inside of the cap is lined with a fine mesh brass wire netting, covering the perforations. Outside of all is a shell 4 inches in length and extending 1/8 inch beyond the end of the cap described. The outer circumference of the cap is flared near the end, so that the only place for the escape of the gas is an annular space 1-32 inch wide between the cap and the shell.

The course of the mingled air and gas in the burner is from the nipple to the closed end of the cap, back through the netting and perforations, and through the narrow space inside the shell to the end of the burner. The gas and air become so thoroughly mingled that the combustion is nearly perfect and the flame is almost entirely blue.

FRANK JOHNSON.

Atlanta, Ga.



Pool System.

David Davis in your March number touched a subject which is of vital importance to a large number of enginemen, inasmuch as many of our leading railroad companies have seen fit to run their engines in the pool system. Mr. Davis has very clearly outlined some of the weak points of this system, and might lead some to think that a railroad company in adopting this plan was in a fair way to pay dividends to coal and oil companies, in preference to themselves. That the pool system has faults, the same as most schemes of human invention, no one will deny; but in judging it we should not do so from a perfection standpoint, but, instead, give it a fair trial, dividing the good points from the bad, and render a verdict according to the evidence.

Sentiment is against the pool system, and it has few friends; but the few it has seem to approve of it, and have had the power to keep it in vogue on several roads for some time. There must be a reason for this. What is it? Mr. Davis says it has necessitated additional help in roundhouses to inspect, clean and do other work on engines that men on assigned engines would do themselves. It occurred to me years ago that a good, bright man to look over engines as they came in off the road would be a paying investment for almost any road, regardless of whether the engineers had a personal interest in the engines or not. And as far as cleaning is concerned, there was a time when a fireman's reputation was based on his ability as a metal polisher; now it is based on a clear sky—that is, if he is a good man he won't darken the heavens like a Kansas cyclone, no matter if he has a heavy train behind him. And if when he gets in off the run there is a man there to put the oil on the engine, wipe off the jacket and paint the front end, I think it is no more than right. Don't you?

As for engineers not being capable of getting the work out of a number of engines, I say, any man who calls himself an engineer ought to be able to step on to any engine on his division and get the best there is out of her, and I will admit there never were two engines alike; but he should be able to do it, for regardless of established customs on his road he may be called upon any day to take a strange engine on a trying run, and what kind of an excuse would he offer for failing to do what another engineer had done daily? Would he say he was a one engine engineer? As for incentive to do good work, when Tom, Dick and Harry all run the same engines there is no reason so far as I can see why the best man won't head the performance sheet if you charge the coal and credit the ton-miles to the engineer and not the engine (a mistaken practice on some roads). Many a man with an assigned engine excuses his presence at the foot of the performance sheet with a "Well, you couldn't expect anything better of me with that old scrap," and knowing the man, I would not expect any better if he had his pick of engines.

It frequently happened when engineers held assigned engines that a small engine and a big train were first out and a large engine and a small train second out. It took a lot of scheming to get the big engine around the small one without running over some one's feelings. Under the pool system the train master orders an engine according to the size of the train, for they are all first out, and as the engine belongs to the company the engineer does not nurse her any but gets the train over the road. The engine may want $5.00 worth of extra repairs when it gets in, but crowding the run may have been worth $50 in other ways.

I once heard an engineer tell the superintendent that if he would cut his train

down from twenty to eighteen loads he could keep his engine out of the shop four months longer. The superintendent told him if he pulled two extra cars over the division every day it would pay for a general overhauling on his engine every two months. I don't vouch for the truth of the statement for I did not have the necessary data to figure it out, but it serves to illustrate that a worn-out engine does not owe the company anything. The pool system will increase the operating expenses of any company, but if its earnings increase pro rata it has accomplished its end. H. J. LEACH.

Eau Claire, Wis.

That Valve Stem Problem.

In answer to Brother J. C. Hill's valve-stem problem, in June issue, I will submit the following. I must have two guesses at what he did do, as I am compelled to give two ways to make stem fast to rod.

First, is to file slot on one side of key-way, another in key, opposite and forward of broken end. Then I think he found a piece of steel wire to fill slotted hole to a driving fit when he drove key home; the wire forming a dowel-pin in slots.

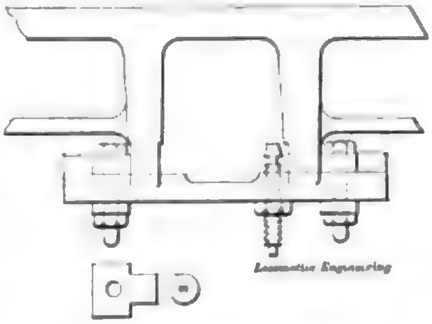
Second, if he only had a rat-tail file and a hammer in tool-box, as is the case on many roads around here, I take it he filed a slot on one side of key-way with rat-tail file, then drove it hard home with hammer, putting key in tool-box ready for new stem. As valve stems do not often break in key-way, I think if Brother Boone broke the other side in the same place 200 miles from shop, he will go one better if he will arrive on time. As Mr. J. C. Hill omitted to give lost time at break-down, I am inclined to think more time was lost than made up on the 200-mile run. Now tell us how you fixed it, Mr. Hill. WM. SUTCLIFFE,

Division 521.

Paterson, N. J.

Improved Pedestal Brace.

We have applied a set of jaw braces to one of our 19 x 24-inch Baldwin moguls, as indicated on sketch attached. The former brace on this engine was the cast-iron block and large bolt, with two wedge bolts, nuts top and bottom of block. This engine has been breaking a great many wedge bolts, and the nuts on large bolt became loose. We have applied this brace to remedy the trouble, and I think we have



IMPROVED PEDESTAL BRACE.

succeeded in doing so. It has Jim Skeevers' center strain on brace bolts, as near as the shape of the frame would permit. The lugs in each jaw are turned to fit snug in the 2-inch holes of the jaw. There are two 1¼-inch bolts which go through this lug.

The end fit of brace is just a little taper to pull these lugs to the frame jaws. The device allows easy access to wedge bolts, and allows space to drop collar without taking down brace. The boys like it; and no doubt it will prevent them from using too many cuss words, as they usually do in setting up their wedges.

If there is anything wrong about it we would like to know. We think LOCOMOTIVE ENGINEERING is the proper place to get this information. ED. SCALLEN,

Foreman V. S. & P. Shops.

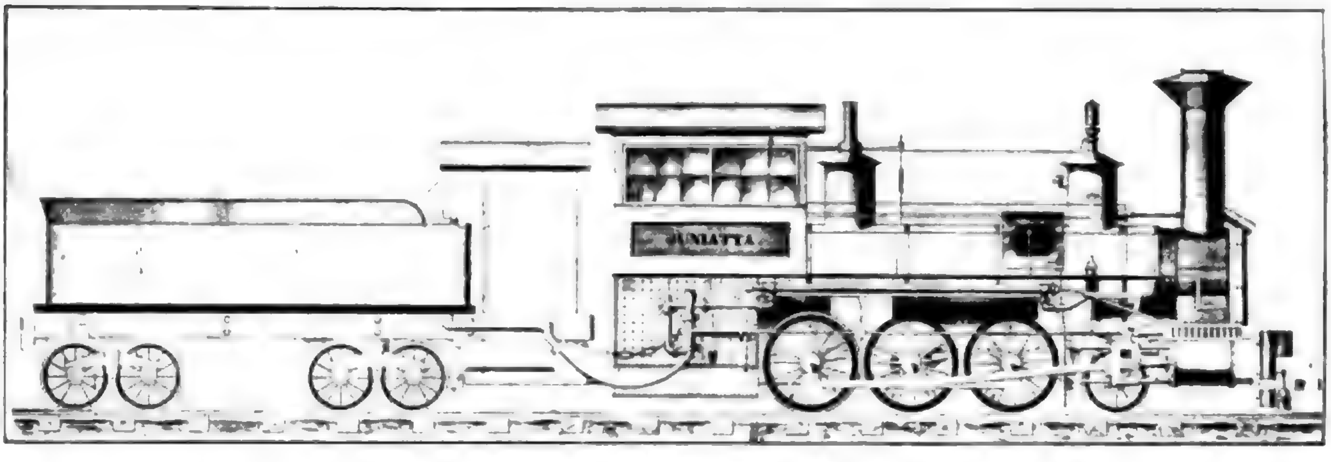
Monroe, La.

Millholland's "Pawnee."

The "Juniata," which is spelled with two "t's" in the engraving, was built by James Millholland in 1855; the first of the type being the "Wyomissing" and the second the "Pawnee," after which the type was called. The former went into service in July, 1852, the latter only a month later. These engines had six coupled wheels and a pair of rigid leaders, or guide wheels, placed back of the cylinders. The firebox was entirely behind the wheels, the frame extending to the front of firebox only. These engines had two combustion chambers; a short one at firebox, and one 3 feet long in the cylinder part of boiler. Flues between the combustion chambers were 4 feet long, and the ones from long chamber to smoke-box 8 feet. The short flues were larger than the others. After a thorough trial the long chamber was abandoned.

The cylinders were 18 by 22 inches; drivers, 46 inches in diameter; leading wheels, 30 inches; boiler, 46 inches diameter; steam pressure, 110 pounds; firebox, 7 feet long by 3½ feet wide.

These were the standard freight engines for the P. & R. R. R. for about ten years. If any of our readers have further details concerning them, we should like to hear from them.



ONE OF MILLHOLLAND'S "PAWNEES," THE JUNIATA.

The danger of using white as an "All clear" signal has again been illustrated in a bad accident that happened on the Philadelphia & Reading a few weeks ago, when the second section of a passenger train ran into the first section, with disastrous effects. A short distance before the point of collision was reached, the brakeman of a coal train waved a white lantern at the passenger engine, as a signal of danger ahead, but the engineer took it as a signal that all was clear.

The Mexican Central are reported to be getting out specifications for particularly heavy consolidation locomotives to be used on mountain service.

A Weed Burner.

On many of the railroads of the West, as well as some of the Northwest, the ballast used is of such a character that weeds grow up so fast it is quite an undertaking to keep them down. Of course, a road with heavy traffic requires good ballast, but the branch lines with a light traffic are not so well fixed. To expedite the process of weeding, a "burner" is used, which, by means of a fire of fuel oil that is fed through a vaporizer by compressed air, and kept close to the track by a shield over it, moving slowly over the road, will burn up or kill by its intense heat every green thing inside the rails, and for a space of from 2 to 4 feet outside the rails.

The Santa Fé Railroad have just built at their Topeka shops, and set to work, one of these burners, which does the business in very fine shape. The illustration gives a good idea of its general construction. It is constructed from an old turntable, with one truck near the center of the burner, so the intense heat does not reach the truck. A shield built up of two thicknesses of sheet steel 6 inches apart, and filled in with mineral wool, protects the bottom of the overhanging part of the frame from the heat, and also confines the heat and flame close to the ground. This shield can be raised and lowered, so it can be 18 inches from the rail when standing still, in order to protect the ties, crossings and bridges from its heat, and 4 inches from the rail when at work. Wings at the sides and one at the end, which are shown lifted up, so that they look like long side steps, are let down, so that they drag on the ground when in action, and confine the flame to a space 9 feet wide and 16 feet long. Three air jets carry out and atomize the oil. With 70 pounds of air the flame fills the whole space under the shield. Three 9½-inch pumps, operated by steam from the engine drawing the burner outfit, are used to supply air. The exhaust steam from these pumps is carried to the end of the burner in pipes shown along the side, and discharged down on the ties outside the rail to quench any fire that may start in old ties. New ones are not affected by the heat if burner is moving.

WEED BURNER OF THE ATCHISON, TOPEKA & SANTA FE RAILROAD.

A 6,000-gallon tank of oil and extra water tender are with the burner. A powerful water pump is part of the outfit, and small pump to take oil out of stationary tanks when necessary to fill the movable one.

The one used last season burned over 900 miles of track, at an expense of about $2.35 per mile. If the weeds were large it could be run 1½ miles per hour. With a light crop 3½ miles an hour was easily made. About a barrel of oil per mile is used for light work.

Be sure you get the Compound Chart this month. One belongs to you.

Along the Atchison, Topeka & Santa Fe Railway.

At the Fort Madison shops, where Master Mechanic T. Paxton is in charge, there is a 26-stall engine house built of stone, with a slate roof, steam heated and electrically lighted. The walls are neatly whitewashed. With two arc lights in each section of thirteen stalls it is light enough to do work on most parts of the locomotives at night without other lights. Incandescent lights are used at the bulletin, call boards and work-book desk.

One matter attended to here, that is a move in the right direction, is the cleaning and the blacking of the smoke arches and stacks by a roundhouse man detailed for this work, who makes it his steady business, and is thus able to do the work more economically and in a better manner than it is done usually. Where the power is of a heavy pattern the firemen have enough other work to do.

The erecting and general repair shop is 125 feet wide by 360 feet long. The machines are located on one side and sixteen pits for engines on the other. Ten of them are drop pits large enough to take the driving wheels out from under a standard eight-wheel engine. One excellent point is that there is plenty of room between all the machines and between the engines for moving the work around. We noted that all journals and piston rods are rolled to a smooth surface. The cast-

iron eccentric cams are also rolled in the same manner, which makes them run cool from the start and last longer. Cylinder packing rings are at first turning larger than the cylinder; when they are cut a lap joint is made. They are then closed together, the joint clamped and the outside turned off to the exact size for the cylinder, so they fit all around, instead of bearing harder at the joint, as is the usual case. A great many kinks are in use here, of which we will speak later. They are too good to pass by without notice. About 125 engines are on the line between Chicago and Kansas City that come here for general repairs, although only a part of them are despatched from Fort Madison roundhouse.

The shops and yard room for freight car work are of a generous size, with plenty of good machinery for all kind of work. Compressed air is used wherever it will expedite business. For hoisting car bodies off the trucks a pair of air jacks are handled by two men who work together, going down a line of cars, hoisting them up one end at a time and placing three-legged trestles under them. As these two men have plenty of this work to do, and the cars to be lifted are close together, they can do it more economically than the other repair men working at the car. An air jack is also used to strip the roofs off old cars, and it does it in short order.

A view of the material rack is an object lesson in convenient arrangement. Every piece of every size has a proper section to be found in, with plain labels over each section. This is the special pride of Mr. Ben Miller, foreman of car repairs, who is credited with a lot of kinks for doing car repair work. The scrap yard is also a model, everything piled in its own proper place separately.

RACK FOR MATERIAL, FORT MADISON SHOP.

As the water supply on the Santa Fé is a matter of great importance, all the exhaust steam from the stationary engines, steam pumps, and steam hammers is sent to a large underground tank. Some of it condenses on the way to this tank, the rest after it gets there. In cold weather the exhaust steam is utilized as far as possible for heating the buildings, and supplemented with live steam when necessary. All the water, steam and compressed air pipes are laid in conduits large enough so the pipes can be got at in case of leaks or changes.

The pumping plant is located below the level of the ground and consists of a double set of Deane duplex compounds, capable of handling 750,000 gallons in twenty-four nours.

A noteworthy fact on this system at all points is the large amount of ground occupied by the repair shops. When this part of the Santa Fé was laid out all the buildings were designed large enough for the heaviest business the road would be expected to do, instead of building them small at the start and increasing their capacity as business increased. "Begin on a small scale and increase later" is the ordinary rule, but in a good many cases the buildings and their appointments do not increase any, and in a few years the work is so crowded that confusion and extra expense is the result. As to the service on the road, it is of the best; the coaches are commodious and in A-1 condition. A large number of them, about 125, have electric lights, the current for which is furnished by a small dynamo located on the truck and driven by a pulley on the coach axle. A storage battery of sixteen cells is used in connection with this lighting plant, which serves as a sort of main reservoir to store the electricity when the car is running and the lights turned off. The light in the coaches is excellent. In a trip of ten days we saw no trouble with it. From seventeen to twenty 12 candle-power lamps are used in each coach, according to its size.

INTERIOR OF FORT MADISON SHOP, A. T. & S. F. RAILWAY, MACHINE SHOP SIDE.

Considerable attention is paid to the subject of smokeless firing, with good results. The trains are run clean and free from smoke and cinders. The time is fast and the trains heavy on this district; but that does not seem to interfere with clean firing.

Haskell's Locomotive.

The illustration shown herewith is one of the four engines recently built by the Chicago & West Michigan and the Detroit, Grand Rapids & Western Railroad, at their shops at Ionia and Muskegon, after designs prepared by Mr. B. Haskell, superintendent of motive power. These engines are in service, pulling heavy fast passenger trains between Grand Rapids and Chicago on the Chicago & West Michigan Railway, and between Grand Rapids and Detroit on the Detroit, Grand Rapids & Western Railroad. They have gained a high reputation for the efficient way in which they do the required work. They are in the same service which is handled by locomotives with 17 x 24-inch cylinders, with a pressure of 150 pounds per inch, on the West Michigan, which shows that a small cylinder and higher pressure make a more effective engine.

HASKELL'S LOCOMOTIVE, CHICAGO & WEST MICHIGAN RAILROAD.

In regard to coal consumption, they are making about 60 engine-miles per ton with a four-car train of heavy coaches, as against 40 miles per ton for the 17-inch engines. Their consumption of water is also much less than the larger cylindered engines doing the same work.

The principal dimensions are: Cylinders 16 x 24 inches, diameter of driving wheels 60 inches, weight in working order 89,000 pounds (51,350 being on the driving wheels). The driving wheel-base is 8 feet; total 22 feet 8 inches. The boiler is 51 inches diameter at the smallest ring, and carries 180 pounds pressure. There are 1,866.74 square feet of heating surface and 16 square feet of grate area.

At the West Burlington shops of the Chicago, Burlington & Quincy they have many labor-saving devices used for the repair of cars, among them being an air cylinder whose attachments for pulling down stringers of cars that are to be heavily repaired. The cylinder is of steel, to make it light and easily handled. It does the work of six or seven men.

AIR JACK FOR CAR REPAIRS, FORT MADISON SHOPS.

Another Rival for the Locomotive.

The atmosphere of the railroad world is in a very frigid condition when some freak machine which is going to banish the locomotive is not almost ready for trial. Since the Holman locomotive has been taken off its stilts and converted into a common puller of passenger trains we have been looking for a worthy successor, and at last we have found it. This time it is the kinetic stored steam motor invented by Arthur Pilsbury Dodge, who claims that his machine is a wonder among locomotives and that it operates without smoke or noise. It sends forth no cinders, has no cab and no tender.

After wading through a three-column article in a morning paper expatiating on the wonderful things the kinetic stored steam motor is going to do, we came to some particulars about what the motor is, and find it to be one of the oldest methods ever tried for transforming the potential power of coal into mechanical work. The power is supplied by a reservoir into which water has been injected at a temperature of about 400 degrees Fahr. Under reduction of pressure this water becomes steam which is used in the cylinders just as it is in any other steam engine. The exhaust steam is condensed in a sort of air condenser set on the top of the car. Baldwin's people have built lots of motors that differ very little from this one.

We only hope that it is not the intention to boom this motor, which is common in everything except the name, by means of a highly capitalized stock company. Such a thing is not outside the bounds of probability.

When the Master Car Builders' convention was attending to the amusement end of the programme at Old Point Comfort, to Commodore Hennessey, M. C. B., was assigned the duty of conveying a party of master car builders (mostly supply men) to examine the Reina Mercedes. The Commodore from Milwaukee entered into a solemn obligation to prevent any of the party from pillaging the vessel, as the relic collecting fiends are notorious for doing. When the visit was completed the officer in charge deemed it right that Commodore Hennessey should give his word of honor that he was not carrying anything away gathered about the vessel. This was done readily. When the party got on board the boat taking them back to Old Point Comfort the individuals of the party began one by one to display the spoils they had carried away from the Spanish cruiser and the Commodore was the only person who had not carried something away.

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Shall Engineers Wear Spectacles?

For a number of years there has been an idea moving around in railroad circles that if an engineer used glasses to assist his vision, it must be an evidence of defective eyesight which would disqualify him from performing the duties of looking out for signals or obstructions on the track when under way drawing a train.

It may be that a fear that the traveling public will be a little suspicious of any engineer who uses spectacles has something to do with the prevalence of this idea; but there is no evidence that the traveling public has ever objected in any way. On the contrary, we think that the opinion of the public is that any aids to better and safer railway service should be encouraged.

That this idea is circulating in a more restricted area year after year is proved by the stand which a good many of the operating officials of prominent railroads take, that when an engineer's vision is not up to the standard he should wear suitable glasses to assist him, for the same reason that a captain of a vessel uses a powerful glass to assist his vision which will enable him to distinguish the exact character of an object that is so distant that it is not plain to the naked eye.

In all the walks of life, just as soon as it is found that the natural vision needs assistance from lenses to distinguish objects at the proper distance, spectacles are prescribed and worn at all times when needed, just as much as an overcoat in cold weather. They not only add to the security, but to the comfort of our everyday life.

An engineer is allowed all the aids that science and inventive genius can supply; expensive apparatus is installed which depends on his keenness of vision for its effectiveness and security. He should have the full measure of security, and be not only allowed, but required, to avail himself of any device which will make him more able to give good service when making a trip. To discern the exact character of objects at a distance is a valuable qualification, and anything that will assist in the process should be used.

We do not mean by this argument to try to prove that men of known defective vision at all ranges should have it made just good enough to pass the lowest safety limit; but we think that all scientific appliances that can aid the vision should be welcomed instead of discouraged. Some men have a good vision at moderately long range and use glasses to read the train orders; others can see at shorter ranges and not clearly at the longer ones.

Engineers' eyes have a very trying service. The dust and cinders constantly flying through the air, which strike the eye with force enough to bed themselves in its outer coating, are a menace to good seeing. Protection in the shape of goggles or plain glass spectacles large enough to protect the eye, is just as necessary as gloves to protect the hands.

As we remember it on a prominent railroad in Massachusetts, the managing officers took a proper stand in favor of protecting the eyes of their engineers, and furnished them with goggles to be used in stormy weather, and required them to be worn. We do not recall just how the plan worked, but it was a move in the right direction.

We are led to these remarks by having a case cited where skilful engineers whose vision was not up to the proper standard were denied the privilege of aiding their vision with spectacles.

Later on we expect to have something to say in regard to this from the oculist's standpoint. We would be very glad to hear from any of the officers who allow their engineers the use of spectacles for long ranges.

Distrust of Iron and Steel for Rolling Stock.

It is wonderful the lack of confidence that certain classes of railroad men have displayed when iron or steel has been substituted for parts of rolling stock formerly made of wood. Iron bridges were at first declared a dangerous innovation that invited disaster, but somehow they stood up without rotting or taking fire, and the prophets of evil were silenced if not convinced. The next object of solicitude among the conservative men was the proposal to use iron or steel frames under tenders instead of the wood that was so short lived. The prevailing argument against iron tender frames was that they would be ruined if the engine went into a wreck. Wood, they said, was cheap, and no great loss ensued when frames of that material were converted into firewood in a collision; but a costly iron frame would be a serious loss when it was destroyed in a similar accident.

These arguments seemed sound and did a great deal to delay the general introduction of iron and steel tender frames. About the time the pioneers of progress were venturing to try iron frames the writer was on a road where two engines were received which had iron tender frames. A few weeks after the engines went into service one met another in a head collision. The other had wooden tender frames and they were fit only for kindling wood when the wreck was cleared away. The iron frame received as severe a shock as the wooden one, for the tank was entirely ruined, but the frames were repaired at an expense of about five dollars. There was no hanging back in specifying iron tank frames on that road any more.

When the use of steel cars for heavy freight began to be agitated the old stereotyped objections were uttered. They might be all right as long as they remained on the rails; but think of the expense that would be incurred when a train of these heavy cars went into a collision! They would be converted into a tangled mass of scrap steel that would be torn apart only after arduous labor. That was what the timid and conservative people said. It is always safest to prophesy after the event. Heavy steel cars have been built and have passed through the wreck ordeal. In an official report made by Mr. Anderson, master car builder of the Pittsburgh & Western, the following facts are stated:

"One of our trains of Schoen steel cars, 100,000 pounds capacity, was going up an 80 to 90-foot grade when ten cars broke off and ran away from the rear part about ninety car lengths. Four more of the steel hoppers ran back down this grade, striking the rear part and damaging P. & W. steel car No. 4001 to the extent of two center sills badly damaged and buckled so much that it was necessary to cut them off and have the bent parts straightened and replaced by riveting on a plate both inside and outside of the channel. It required a new end sill; but the old end sill removed was in shape to be used in repairs to other cars, as we straightened and plated the fractured part so as to have it ready for other damaged cars. The material required amounted to $12.70. The labor amounted to $27.60, making a total

of $40.30 to put car in good, first-class condition.

"Steel car No. 4351 was in accident on the Baltimore & Ohio Railroad. The cause of accident is not known, but the car was sent home for repairs, having end sill, side sill, corner post and stake very badly damaged, and it had appearance of going to be a very hard job to make necessary repairs. But we found that we made the necessary repairs very easily, and put the car in good first-class condition by using one end sill, one corner post and one side stake, and straightening out the side sill by building a fire under it and using hydraulic pressure for straightening it out. The material used on this car amounted to $10.40, and for labor $28, making a total of $38.40.

"Steel car No. 4211 left the track known as our Negley stone track, which is about 10 to 15 feet higher at the point where the car left track than our main line. The car went over the bank, landing on the main track and blocking the road. Our superintendent happened to be on board a passenger train which came up behind this trouble, and cleared the track by use of engine and chains. This car was under load of 100,000 pounds of crushed stone. The sides were crushed in about 18 inches, bending all the side stakes on each side of the car, and breaking four journal boxes, one brake shaft, two handholds, one winding shaft bent, dropdoor attachment bent, brake levers and guides torn off, truck channel bent and brakebeams torn off. The pressed steel diamond truck under this car was subjected to a great deal of rough usage in getting the main track cleared, as it would be reasonably supposed that the body of car received some very rough handling to avoid delay to trains. I supposed that I would have to remove all side stakes on account of their bent condition, but, fortunately, we made a good first-class job by using hydraulic jacks and hammering on the stakes until we got the side straightened. The material required amounted to $8.37, labor $30.60, total $38.97.

"The opinion was expressed that if a train of wooden cars had been subjected to the punishment that car No. 4001 was subjected to, there would have been nothing left but the scrap. In this case this car was the only car damaged in the train, it being so solid, substantially built, etc., that all other cars behind it were protected. A wooden car would not have stood the punishment that No. 4211 went through under such heavy load."

Railway Mechanical Engineering.

In a pamphlet recently issued by Professor Hibbard, of Sibley College, Cornell University, on "Summer Vacation Work in Railway Locomotive Shops," very good arguments are used in favor of railway mechanical engineering. The principal points made are:

"After graduation the student may enter upon locomotive or car designing and particularly manufacture, in contract-shop locomotive or car works; or he may prefer to enter the railway service, where, with some designing of new work, he will devote the greater portion of his time as mechanical engineer, master mechanic or superintendent of motive power, to the use and repair of locomotives and cars, to increasing their efficiency and usefulness, and to the solution of the thousand and one problems of rolling stock, shop management, equipment and supplies, that in their profusion and variety go to make up the ever-changing, free-from-ennui experiences of the modern railroad man.

"Besides the above two branches, rolling stock manufacture and railroading, a third is coming to be recognized, evolved as the result of the recent entrance of the technical graduate into our railway motive power departments. It is that of the technical 'supply man.' In addition to the technical graduate already so largely found as a shop manager, we are now beginning to see technical men as the representatives of the business house supplying its product to the railway. This product may be car trucks, boiler steel, paint or turret lathes. Whatever the product, the new sales agent is becoming prominent.

"At a recent meeting of the New York Railroad Club, the subject was discussed by a large number of motive-power officers, railway purchasing agents and 'supply men.' It became apparent that practical wisdom called for a man who could present the scientific advantages of his axle steel or leaf spring to the modern superintendent of motive power accustomed to look into the real scientific reasons for the defects in his rolling stock or shop tools. The writer is free to say that in his locomotive shop and railroad experience he has met many supply men who were unable apparently to understand these defects. They could reiterate simply that they were sure anyhow that their paint was the best in the world, confessing ignorance as to required previous condition of the surface, perhaps the most vital point. Persuasive promoters may not be coldly scientific reasoners. The supply mechanical engineer gets the ear of the superintendent of motive power when the ordinary sales agent cannot. That means the difference between success and failure.

"For the future locomotive or car manufacturer and the supply man, the summer in a railroad shop would be the more valuable; for the future railroad man, the locomotive works. The student who is now a freshman may profitably spend a summer in each and the third in a drafting room.

"The railroad repair shop teaches the need of standard designs and of interchangeability, how the locomotive or car gives out and is repaired, where it wears, what parts see the hardest service and need soonest to be replaced, how long staybolt iron will last, into what condition a journal box may be allowed to get and still run cool. These items and many more are of incalculable use to the man who would design and build locomotives that will be good when old; or to the supply man who would tell why his driving wheel tires ought to be bought rather than Krupp's. In fact, the superintendent of our largest locomotive works tells the writer that he prefers to take technical graduates after a short railway shop experience, rather than directly from the technical school, citing the cases of himself and other officials that have come from railroads."

Home-Made Locomotives.

We have recently illustrated and described various home-made locomotives, so to speak, and we are always ready to do this for we consider that locomotives built in railroad repair shops are likely to embody the most advanced practice in making the engine as convenient as possible to handle, and designed with a view of rendering repairing as easy as the case will admit of. Home-made locomotives do not always turn out this way, for we have in mind a lot of engines turned out of a New England shop that had to be jacked up before the side rods could be put up or taken off. But that was an exception and does not reflect on the general merits of the home-made locomotive.

The fact that good locomotives can be made in railroad shops is not, however, an argument in favor of the advantage or utility of railroad shops building their own engines. Towards the end of the hard times, happily passed away for the present, when railroad companies were becoming short of motive power a tendency was manifested to claim that railroad companies could build their own locomotives cheaper than they could buy them.

This is a claim that comes up periodically, but it is a delusion. We believe that it pays every railroad company operating more than one hundred locomotives to have one or two new engines under construction, because it equalizes the work and keeps tools going when there is not enough repair work to prevent their being idle. The practice also enables a master mechanic to keep together his working force without unduly reducing the hours of labor. But when the men in charge of a railroad repair shop urge the management to enter into the business of building locomotives to supply the needs of the company, they advocate what is certain to result in loss if adopted. The most celebrated case of a railroad company entering systematically into the work

of building its own locomotives in the United States was that of the Pennsylvania Railroad, and the plant established for doing the work was as perfect in every detail of equipment and the organization was as perfect as that of any concern established for the building of locomotives. Yet there is good reason for believing that the railroad company would have saved considerable money during the last five years had the Juniata shops not been built.

Our railway officials are becoming so familiar with the practices followed by railway companies abroad that they are inclined to take inspiration from foreign compeers. After returning from a trip to Europe they come home and ask, Why can't we make it a paying business to build our own locomotives and cars when that work is done by nearly every railroad company in Europe? The conditions are entirely different. The business of European railways is fairly uniform from month to month and year to year, even including hard times, and the companies can count upon employing a certain force of men on manufacturing work without danger of receiving orders to reduce the force to meet the demands of stock manipulators. On most of the railroads in the United States it is the practice when business becomes depressed or wild competition makes rates unremunerative, to reduce the men on the pay list so that the net earnings may seem good. On most railroads it has been the practice to reduce the working hours in shops. This is an expensive policy in the end, but it will probably always be followed. If a big railroad company had a big manufacturing establishment where thousands of men could be turned idle with every depression in earnings, it would be an intensified evil for the railroad company, for the men it used as human puppets and for the best interests of the community.

The fact of the matter is that railroad companies have been organized for the purpose of transporting freight and passengers, and not for entering the industrial field as manufacturers. Our successful manufacturers are beating the world because they do their work by specialists operating highly developed special machines. Until railroad companies are prepared to adopt similar methods, they had better leave the building of locomotives and cars to people who are properly equipped for doing the work.

Bringing the Railway Mechanical Conventions Closer.

When the Master Car Builders' Association and the Master Mechanics' Association were organized, the members of each association, as a rule, had nothing to do with the duties of the men constituting the other body, and it was eminently right and proper that the men in charge of cars should form themselves into one organization, while the men in charge of motive power should establish another. That was over thirty years ago, and many changes have taken place in railroad management since that time which have made changes necessary in conducting the business of the mechanical associations. Each was originally formed independent of the other, and there was very little disposition manifested to have any dealings with each other. The meetings of the associations were held independently without place or time of the other receiving any consideration.

As years rolled onward, railroad managers gradually adopted the policy of consolidating their car and locomotive departments under one head. A very pronounced tendency was shown to put the master mechanic in charge of the car department. The man who thus had his jurisdiction extended had very likely been an active member of the Master Mechanics' Association and participated in the wide range of engineering investigation and discussion which that association always enjoyed. His control of the car department required that he should attend the Master Car Builders' convention to watch the interests of his road in the discussion of the rules of interchange of cars. This necessity raised the demand that arrangements should be made to have both conventions meet at the same place and in succeeding weeks. The Master Car Builders' Association, jealous of the increasing influence of the other association, persistently refused to give aid or support to any scheme proposed for making it convenient for a man to attend both conventions with the least possible loss of time and minimum of travel. The Master Mechanics, however, established a rule to meet the week after the Master Car Builders held their convention. That was the first practical success in the attempt to bring the associations nearer together.

A few years more rolled by, and the superintendent of motive power and the master mechanic became the dominating power in the Master Car Builders' Association. Earnest efforts were again renewed to establish more harmonious relations between the Master Car Builders and the Master Mechanics. The outcome of this agitation was that an arrangement was entered into by which the two associations agreed that the place of meeting for both organizations should be selected by a joint committee of both bodies.

That was an important step in the right direction, but it did not go far enough. A feeling grew and strengthened that some arrangement should be made by which the business of both conventions should be conducted to a finish in one week. Many of the members believed that the proper solution of the question was the consolidation of both associations into one, and that may finally come about, but the time is not yet ripe for such a radical move. But a compromise has been effected which may obviate the necessity for uniting the associations. Time and experience with the new arrangement will be necessary to prove its utility and convenience.

In his inaugural address at the opening of the Master Mechanics' convention, President Leeds took strong grounds in favor of consolidation of the two associations. This resulted in a committee being appointed to consider and report upon the recommendations made. That committee reported at the Old Point Comfort convention, recommending the consolidation of both associations. The final paragraph of the report contains the gist of the whole thing. It reads:

"Your committee would therefore recommend that the executive committee of this association be and are hereby instructed to at once confer with the executive committee of the Master Car Builders' Association and endeavor to arrange for a consolidation of the two associations under such name and conditions of membership as will do full justice to both associations and accomplish this very desirable object, and the president of this association is authorized and directed to appoint a special committee who shall also be members of the Master Car Builders' Association to attend the next annual meeting of the Master Car Builders and present this subject for consideration."

In connection with that report, Mr. J. H. McConnell made a report to the Master Car Builders' convention recommending that the conventions should meet jointly on the second Tuesday of June, and that each day should be divided up for the sessions of both associations. This was finally modified by a motion to give the executive committees of both associations the authority to carry out the arrangements for next year's meeting. The Master Mechanics' Association agreed to that and there the matter rests.

Premium Plan of Paying for Labor.

In 1890 Mr. Fred. A. Halsey, then general manager of the Canadian Rand Drill Works at Sherbrooke, Canada, presented to the American Society of Mechanical Engineers a paper in which details were given of a plan he had worked out for paying labor, which has come to be known as the "premium plan." When he took charge of the works referred to, Mr. Halsey understood that it was necessary to keep down the cost of production as low as possible. He recognized the shortcomings of the piece-work plan of paying for work done, and was drawn more towards the profit-sharing plan which was receiving a great deal of attention at that time. It was the study of this plan that induced Mr. Halsey to work out the premium plan, which he considered fairer all round.

Recognizing the unceasing conflict in which the workman tries to sell his labor

as high as possible, and the employer tries to buy it as cheaply as he can. Mr. Halsey worked out in the premium plan a method which would increase the workman's pay per day and decrease it to the employer per unit of product. It is an application to production of methods long in use in connection with sales. The plan of offering a salesman a salary and a commission is closely analogous to the premium plan, and if for the salary he is expected to sell a certain minimum of goods per annum, the commission applying only to the excess above this minimum, the analogy is exact. Under the premium plan the workman is paid by the day, and for this daily pay is expected to produce a certain minimum of product, while for any excess beyond that amount he is paid a premium, the amount of this premium being based on the excess and being less per unit of product than the old wages cost. It is applicable to any class of work of which the output can be reduced to units.

Taking round numbers for convenience, suppose a workman to be paid $3 per day of ten hours and to produce one piece of a certain kind per day. The wages cost of the product per piece is obviously $3. Now, under the premium plan the proprietor says to the workman: "If you will reduce the time on that piece, I will pay you a premium of ten cents for each hour by which you reduce the time." If a reduction of one hour is made, the first result to the employer is to save the wages of 30 cents for the hour which has been saved, but against this is to be placed the 10 cents earned as a premium, leaving a net gain of 20 cents to the employer and a net increase of earnings of 10 cents to the employé. Had the premium offered been 15 cents, the result of an hour's reduction of time would have been to save 15 cents to the employer and to increase the workman's earnings by the same amount. The result of any saving is therefore divided between the two, and in a proportion determined by the proportion established between the wages rate and the premium rate, of which more hereafter. It is obvious to all, however, that the gain to the employer does not stop here—the gain due to the increased output from a given sized plant being additional to the immediate cash gain. In the case of large expensive tools the gain due to increased output may easily far exceed the gain due to the reduction of wages paid per piece.

Although manufacturers and machine-shop owners are exceedingly conservative about changing their methods of paying for labor, the premium plan made considerable impression, and after waiting eight years one of the leading manufacturers in New England adopted the system, and acknowledged that it did all that was claimed for it—i. e., to cheapen production and raise wages. Mention of the system having been introduced into that shop was made in the pages of the *American Machinist*, and a demand at once arose for a description of the system. It was again written up and published in the *American Machinist*, and the paper containing the description was so much in demand that the supply was soon exhausted. To meet with the increasing demand the American Machinist Press have published a full description in pamphlet form, which they will send free to anyone who applies for the pamphlet.

To Make Tonnage Rating Successful.

In our Correspondence Department will be found a letter on "Tonnage Rating and Fuel Records," by Mr. J. H. Goodyear, assistant general superintendent of the Buffalo & Susquehanna Railroad, which presents a particularly clear view of the advantages of tonnage rating and a good method of operating the system. When this system was introduced on the Chicago Great Western, Mr. Goodyear had charge of the work, and the scheming of many of the details was done by him. By the introduction of the system it was estimated that the company saved $100,000 in the first year it was in operation. Mr. Goodyear believes that next to keeping accurate and fair accounts, the success of the system was due to the fact that an opportunity was never lost to explain the methods to the men most interested in its operation. This helped to spread confidence in the fairness of the system and in the accuracy of the performance sheets.

Like many other newly introduced methods for increasing the economical operation of railroad motive power, the tonnage rating system has been successful on some roads and an utter failure on others. When a system can be made a success on one road we cannot see why there should be insuperable difficulties in making it a success on others, if the same means to instruct trainmen about it are employed. But the fact is, that the officials on many roads consider all that they have to do to introduce a new system successfully is to issue an order and inflict pains and penalties when its behests are not carried out. They do not realize that a period of training has to be passed through, and that they ought to act the part of patient teachers. The man who is above acting as an instructor is not adapted to managing railroad trainmen successfully.

BOOK NOTICES.

"Patents and How to Make Money Out of Them." By W. B. Hutchinson and J. A. E. Cresswell. New York, D. Van Nostrand Company. Price $1.25.

Apart from the useful information which it gives for people who are owners of patents, this book contains a great deal of interesting matter relating to the development of the world's industries and the influence that patented articles have exercised in facilitating and cheapening the production of articles that are now almost essential to the comfort and convenience of mankind. The main object of the book, however, is to let inventors know how to make money out of their patents. It is written by practical business men whose advice is well worth having. All inventors who secure patents ought to have a copy of this book for reference and advice.

"The Influence of Mechanical Draft upon the Ultimate Efficiency of Steam Boilers." By Walter B. Snow. Reprinted from *The Columbia Engineer*, New York.

This is a lecture delivered by the author before the Engineering Society of the Columbia University, New York. Mr. Snow has made a study of the subject of forced or mechanical draft, as well as that of ventilation, and his statements carry weight. It is simply another instance of the value of the publications by enterprising concerns who embody sound engineering in their advertising literature. Numerous instances of the application of these appliances are given, and the comparative costs are more interesting to the manufacturer than to the builder of chimneys. The saving resulting from using mechanical draft and lower grades of fuel is also interesting. Anyone interested should send to the B. F. Sturtevant Company for a copy of this.

"The Steam Engine Indicator and Its Appliances." By William Houghtaling. Published by the American Industrial Publishing Company, Bridgeport, Conn. Price $2.

The three hundred pages of this book seem to be filled with the kind of information sought for by those who expect to use the indicator, and probably most of those who have used the instrument could obtain points of value from it. Beginning with a brief history of the indicator, it takes the reader through the construction, care and use of it, together with the appliances, in easy stages and with plain language. Reducing motions, electrical attachments and drum stops are carefully considered. The study of the diagram itself is interesting, and the lines, points and curves receive careful attention. Steam expansion, re-evaporation, water consumption, etc., etc., all receive attention, and the reader cannot fail to be both interested and instructed. There are several tables of value, and, as a whole, the book is worthy of commendation.

"The Paint Wonder" is the title of a little pamphlet which is being sent out by the Shearer-Peters Paint Company, of Cincinnati, Ohio. It makes some pretty positive statements about preventing rusting of metallic surfaces from *any* exposure, as well as making a coating that is neat in appearance. But as they stand ready to forfeit $1,000 to anyone who can prove that every statement is not ab-

solutely correct, there is little room left for doubt. The Pittsburgh, Bessemer & Lake Erie Railroad have ordered it for locomotive front ends, and others have used it very successfully in about every service. A trial can be made at the slight cost of $1, and those who use it say they wouldn't be without it. A pamphlet will be sent on request, and it's worth asking for.

Alexander Johnston Cassatt.

When the monarch of a country which has one hereditary head dies, the people shout or the proclamation goes forth, "The king is dead; long live the king!" Some old-country corporations have a new president ready at all times for filling the blank that death leaves; but there are few companies in this country where one president is ready to follow another without question or conflict. One of the few companies of this character is the Pennsylvania Railroad Company. The death of President Thomson led to no speculation or uncertainty about who the next president would be. The splendid organization of the company always keeps a number of highly trained men ready to fill the highest position; but there is always one so prominently above the others that his election is almost certain. This time the president chosen was Mr. Alexander Johnston Cassatt, one of the directors, who was formerly an active officer, and, like all other Pennsylvania officials, went through a course of thoroughly practical experience.

Mr. Cassatt was born in Pittsburgh sixty years ago, and received an engineering education in the Rensselaer Institute, Troy, N. Y. He did some work on railroad location in Georgia before the war. When the clouds of conflict made the South uncomfortable, he returned North and went to work as rodman on what is now a part of the Pennsylvania Railroad. After several moves upwards, Mr. Cassatt was made superintendent of motive power of the Philadelphia & Erie in 1866, and the following year took charge of the mechanical department at Altoona. After holding that position for four years he succeeded Dr. E. H. Williams as general superintendent.

For three years Mr. Cassatt was general manager of the New Jersey lines, and while holding that position demonstrated the commanding executive ability which is one of his strong characteristics. After several other advances he retired in 1882, with the intention of leading a life of ease, but a few years later was induced to return to the board of directors. The great Pennsylvania Railroad Company is safe with Mr. Cassatt at its head.

Frank Thomson.

Frank Thomson, who became president of the Pennsylvania Railroad two years ago, died last month. Mr. Thomson was fifty-eight years old, and all his working life was spent with the great company of which he became president, except a few years during the war of the rebellion, when he was in the transportation department of the United States Government. He began his railroad career by entering the Altoona shops as an apprentice, where he remained four years. Just as his apprenticeship was finished, the war broke out, and Colonel Scott, then president of the Pennsylvania Railroad, was made Assistant Secretary of War. Colonel Scott assigned to Mr. Thomson the work of transferring locomotives by water from Washington to Alexandria, which was performed so promptly and satisfactorily that he was kept for three years supervising military railways. Then he returned to the Pennsylvania and was appointed division superintendent. Nine years later he was promoted to be superintendent of motive power. He held that position little more than a year, when he was advanced to be general manager of the lines east of Pittsburgh. Through the steps of vice-president he then rose to the top.

THE LATE FRANK THOMSON.

Mr. Thomson was an ideal railroad manager. He could do any kind of work that men are employed upon in the operating of a great railroad, and consequently he could always tell when a division or a department was properly operated. He was of a highly sympathetic nature, and his subordinates became his friends. He had a kind word and friendly smile for every entity in the great crowd that operates the Pennsylvania Railroad, and hundreds will miss him for more substantial kindness than good words.

Conflicting Verdicts.

There were two curiously conflicting verdicts rendered by two different coroners' juries that investigated the cause of a bad collision which happened on the Philadelphia & Reading on May 12, by which twenty-nine persons were killed. The company were running a passenger train in two sections that were expected to run five minutes apart. When the first section got six miles from the starting point it was stopped by signal for orders. The train ran past the order signal and backed up to it. Before this train got started the second section ran into it with the disastrous results stated. There was some conflict of testimony as to the time that elapsed between the stoppage of the first section and the collision. The difference in dispute was two minutes. Orrell, the engineer of the second section, was not in the habit of running passenger engines.

The first inquest was held near the scene of the accident, and the jury practically found everybody connected with the running of the two trains responsible for the accident, besides the train dispatcher and train master, and warrants were issued for the whole of them. The verdict was very much like the methods of certain superintendents in the old days before brotherhoods began to insist on placing responsibility exactly where it belonged. The blanket plan of punishment in those days was to discharge everybody connected with trains that came in collision. It was a very easy way of reaching a decision, but the real guilty party often escaped. It looks as if the parties really responsible for the Philadelphi & Reading collision escaped the net so widely spread out by the coroner's jury in the first inquest.

Because several of the people injured in the accident died afterwards in Montgomery County, Pa., the coroner at Norristown held a separate inquest. The jury in this instance found the railroad company primarily responsible for the accident, because it had never established a modern and adequate system of communication by telegraph or telephone between signal stations and the main office; because it dispatched trains at too short intervals; because it failed to provide a sight and color test at least once a year for employés required to distinguish colors on signal boards at a distance, and failed to require signal-tower men and crossing watchmen to have accurate timepieces. The belief was also expressed that there is absolutely no safety in running trains according to the system and rules used. The decision was arrived at that mistakes

were made by the employés, but that they were not sufficient to have caused the collision, had a proper system of signals been in use on that portion of the road.

Lehigh Valley Railroad Matters.

As far as equipment is concerned, the passenger equipment of the Lehigh Valley Railroad is probably in better shape than ever before and of a higher order of excellence. In addition to this, during the past six months the company have put through the shops two baggage cars and four coaches, which were practically rebuilt, being equipped with wide vestibules and smoking compartments. A parlor car is now in the shop for wide vestibules, and two more coaches will be equipped with wide vestibules and smoking compartments within the next sixty days. In addition to this, four baggage cars are being built, two of them being 60-foot cars. At the company's request, the Pullman Company took into the shop the parlor cars running between Philadelphia and Buffalo, and applied wide vestibules. The Pullman Company also placed new superior sleepers in the New York & Chicago line early in the winter.

As far as locomotives are concerned, in May and June the company received nine heavy pushing engines for the Wyoming division, and later on will receive twenty-five heavy consolidation engines for the Buffalo division. Each one of the nine pushing engines will replace two of the light pushing engines that the company have been using, and they can then use the light pushing engines as road engines on division where the grades are not so heavy, thus dispensing with the lightest road engines that are now on these divisions. The twenty-five heavy consolidation engines for the Buffalo division will enable the company to handle, on that division, trains weighing 2,000 tons, omitting weight of engine and tender. These trains are now handled by two engines, or what is known as "double header," and the use of double-headers on the Buffalo division will be stopped.

Relieving the engines from double-heading service will enable the company to use some of them on the Pennsylvania & New York division, east, in place of light engines, which will be set aside. This will result in their taking out of service this year not less than fifty-three of their lightest locomotives that are to be sold or condemned.

So far as the coal-car equipment is concerned, the Lehigh Valley Railroad have sold 12,000 four-wheel coal cars, capacity 6 tons each, and will substitute 1,000 coal cars capacity 80,000 pounds each, and 1,000 coal cars, capacity 100,000 pounds each.

The Lehigh Valley Railroad Company are applying air brakes and Master Car Builders' couplers to old car equipment, so that by the end of the present fiscal year the company will have 51 per cent. equipped with air brakes and 86 per cent. with couplers. In the application of air brakes the company substitute metallic brake beams for wooden brake beams, and in the majority of cases in applying couplers they substitute an improved draft rigging for what has been in service.

The company are strengthening their twin hopper coal cars by introducing larger truss rods, so as to keep the cars up better at the center.

As far as car and locomotive shops are concerned, the company are putting up a machine shop extension, new paint shop, new blacksmith shop, new power plant, new car repair shop, new locomotive coaling station, new cabinet shop and new upholstery shop at Sayre, and are to remodel the buildings at Weatherly for locomotive repairs, also making some improvements at South Easton which will result in concentrating all of their passenger car repair work and box car repair work at Sayre, coal car work at Packerton, and will result in the closing of the locomotive shops at Hazleton and Delano, and passenger car shops at South Easton, Delano, Hazleton, Ithaca and Cortland.

Passing sidings at about twenty different points along the lines are being constructed to give better facilities for movement of trains. Also six and a half miles of third track on the up-grade, westbound, from Landsdown up to Musconetcong Tunnel. The revision of Sayre yard is contemplated in connection with new shop extensions under way at that point.

ONE OF THE LEHIGH VALLEY FLYERS.

New interlocking plants will be put in and old ones remodeled at about half a dozen places. Additional Hall automatic signals will be put in at various points on the Easton & Amboy; also on the west-bound track on the mountain cut-off, and for a distance of ten miles out of Buffalo, both tracks.

In addition to these the usual repairs of bridges and structures all along the road, renewing about twenty large iron bridges and twenty or more small spans. Also painting of buildings and bridges.

The passenger service of the Lehigh Valley has been earning praises from business men, with their Black Diamond and other through trains. These are hauled by engines of the Atlantic type, one of which is shown with this. They have 19 x 26-inch cylinders, 76-inch drivers, 61-inch boilers with 216 2-inch tubes. These give a heating surface of 2,081.24 square feet, and the 148.98 square feet of firebox surface brings the total up to 2,230.22. The firebox is 83⅜ inches wide by 114⅝ inches long. These engines weigh 142,000 pounds, of which 82,000 is on drivers. Tank capacity is 4,000 gallons, so as to avoid frequent stops for water. The photograph from which the engraving was made was taken by Mr. F. W. Blauvelt, of New York.

Compound Locomotive Chart No. 3.

This month we illustrate the Richmond compound locomotive in the same manner as the Schenectady and the Baldwin.

In the compound position the exhaust from the high-pressure cylinder goes into the pipe marked "Receiver from high to low-pressure cylinder," at the rear, which is part of the one marked "Receiver," in front of the exhaust pipe. The steam flows down into the passage shown, through the valve which is shown open, and into the "Passage to low-pressure cylinder." The low-pressure exhaust goes into passage marked "Exhaust," and to exhaust pipe. This passage is behind the passage directly under the receiver, and should not be confounded with it.

In working the engine simple, live steam is admitted to the low-pressure cylinder by steam pipe shown; connection with passage marked "Live steam to low-pressure cylinder" being through the box-like casting in the back of passage below the "receiver." The reducing valve at the right admits the desired pressure into "Passage to low-pressure cylinder." The valve between this and receiver now being shut, this goes direct to low-pressure cylinder, and not into receiver passage.

The low pressure exhausts as usual. The high pressure exhausts into receiver as before, and steam being turned on from cab to force emergency exhaust valve open, the steam passes through there and into the main exhaust, through passage shown broken away to make this clear.

Handling the Richmond Compound.

BY ROBERT RENNIE.

It may be assumed that the compound locomotive is no longer an experiment, but a successful, economical machine. The experience of the Canadian Pacific Railway is now so well known that the two-cylinder type no longer needs an apologist.

In the Richmond type we find three valves controlling and directing the steam in its passage through the cylinder in addition to the slide valve.

The largest of these valves is the intercepting valve proper, controlling the connection between the high-pressure exhaust and the low-pressure steam supply; an emergency valve, controlling the connection between the high-pressure exhaust and the atmosphere, and a reducing valve, controlling the independent admission of live steam to the low-pressure cylinder. This latter valve is of exceedingly simple construction, being merely a cylindrical sleeve sliding on the stem of the intercepting valve.

The operation of the various valves is as follows:

The high-pressure cylinder exhausts into a receiver, which is placed inside the smokebox and opens into the chamber. The intercepting valve, as shown, has a piston on its outer end, which acts as an air dashpot, preventing any slamming of the valve. Around the stem of this valve is a sleeve, which has an axial movement on the stem, and acts as an admission and reducing valve to the low-pressure steam chest when starting and when working simple. The valve is a plain, bevel-seated, winged valve, and is called the emergency valve, as by its use the engineer can, at will, operate as a simple engine.

When starting, steam from the boiler goes to the high-pressure cylinder in the ordinary way, and also to the port through a 3-inch steam pipe connected to the dry pipe. When the throttle is opened, no matter in what position the valves stand, there is no pressure in the receiver, and the pressure on the shoulder of the sleeve moves the sleeve and valve to the right, closing the receiver and letting steam past the shoulder into the low-pressure steam chest.

Now, since the area of the end of the sleeve is, say, twice that of the shoulder, half of the boiler pressure will move the sleeve to the left, cutting off steam through port, and thus equalizing the work in both cylinders, since the reduced pressure is thus maintained in the low-pressure steam chest by the reciprocating action of the sleeve. After, say, one and one-half revolutions, the pressure accumulates in the receiver, due to the exhaust from the high-pressure cylinder, and acting against the large face of valve; moves this valve to the left, carrying the sleeve with it, thus opening a straight connection between the high-pressure exhaust and the low-pressure steam chest, and at the same time permanently cutting off live steam from port.

In starting on grades, or when exerting maximum power, the engineer can move the three-way cock in the cab, letting boiler steam behind the piston on the emergency valve, and holding it open against its spring. This exhausts the small cavity in which the pressure is equalized with the receiver through holes in the rear end of valve; and then the valve, being unbalanced, moves with the sleeve instantly to the right, assisted by steam pressure on the shoulder of the sleeve. The high-pressure cylinder has now a separate exhaust around the end of valve, through valve, into the main exhaust, since the intercepting valve remains closed, due to no accumulated pressure in the receiver. The low-pressure steam chest then gets reduced pressure steam direct from the boiler through port and reducing valve.

Except when working simple, the valves act entirely automatically.

Owing to the small area of port, and the contracted exhaust through valve, the engine develops less power as a simple engine than as a compound, at a speed of over, say, eight or ten miles an hour, and thus the runner is compelled to work compound. Should either side break down, the emergency valve can be opened and the engine brought in on one side like an ordinary simple engine.

The equal division of the power between the two cylinders, at varying speeds and loads of the locomotive, is effected by giving the low-pressure valve amounts of lead and lap differing from those of the high-pressure valve. Thus, each cylinder has a point of cut-off differing from that of the other, for the same position of the links, the latter being of the usual type.

The large low-pressure cylinders of the compound locomotive magnify, to an extent of importance, an evil which, with the smaller cylinders of the corresponding single-expansion type, is negligible. When steam is shut off, in running down-grade, the pistons act as air-compressors, producing thumping, rough riding, cooling of the cylinders and a strong jet in the stack, at a time when no steam and practically no draught are required, with a consequent waste, in excessive blowing from the safety valve.

This action is prevented, in engines of the Richmond system, by certain overpass valves, one for each end of the low-pressure cylinder, placed together, within a chamber in the cylinder-casting, at the side of the steam chest.

It is essential that on a hilly road these valves work smoothly and promptly, as a failure to properly open at once manifests itself when the engine is shut off and allowed to roll down hill. A disagreeable thumping is promptly noticed, as well as a more or less violent longitudinal oscillation.

I have often wished I could eliminate

all the thump when running under steam, especially on an engine that has been in service some time, but every time I thought the desired result was at hand a hot pin has made me wish I hadn't tried it.

In an old compound the thump is unquestionably worse than in a simple engine of the same age and condition of bearings, which may worry a runner with a sensitive ear, but I notice the man who is not eternally monkeying with his wedges and keys does not break the seal on his emergency oil can quite as often as the other fellow. Also he has not so much to write in the work book when he gets in.

Regarding the use of the throttle, I am not willing to give any hard and fast rule, as I do not believe it can be done. In general, less throttling should be done on a compound than on a simple, but many cases occur where it is undoubtedly economical to slightly close the throttle and lengthen the cut-off a few inches. I do not wish to convey the idea that the proper way to run a compound is pull the lever up three or four notches and then run by the throttle. This idea is altogether too prevalent. Nor do I believe that it is always good policy to open the throttle wide and then notch the lever back until the desired speed is attained. The best course is between the two extremes and must be determined according to grade, schedule and other conditions.

Lubrication is another thing that depends largely on the character of the road. Generally, when using steam six to ten drops a minute on the high-pressure side is ample, the low-pressure side being entirely shut off. When drifting, of course, both sides must be fed; a slight excess being given to the big cylinder.

Carrying water depends largely on the type of boiler, but the high water men will not make a very good showing on their oil record. I do not believe in any more water than is required for safety. When taking a run for a hill the reverse lever can be dropped into the corner without tearing the fire or raising the water as much as with a simple engine.

As to the care and lubrication of the intercepting valves, the best course is to let them severely alone. The steam takes care of that, and a few drops of oil before starting out of the yard, fed through the low-pressure side of the lubricator, is sufficient.

Heating Iron Electrically.

I noticed in your June number of 1899, in the article on page 297, "Iron Made Red and White Hot in Water," that the explanation given is not quite correct. I have seen this method of heating iron myself, and do not think that a film of nitrogen serves to protect the iron from the water. Nitrogen, being no constituent of water (chemically H_2O), is not involved at all, and neither hydrogen nor oxygen can form a film around the metal, for these gases bubble up through the water from the electric poles as soon as water is decomposed. My opinion is that the water around the iron protects it, for this is heated to steam, and therefore can form a complete coat around the iron, which the constituents of water could not do.

E. H. Bendel.

Sims, Shasta Co., Cal.

Oliver H. Ohle, of West Penn, Pa., is in jail waiting to be tried for murder done by derailing a train. That is the worst kind of wholesale murder, and it is a pity that anyone guilty of such a heinous crime escapes the death penalty. If hanging for this crime were common there would be less train wrecking.

An Incident of the Old Point Comfort Convention.

Last week we received a letter which may prove interesting to our readers on account of its connection with the collision at sea of the Ward liner "Macedonia" and the Old Dominion Line steamer "Hamilton," the latter ship having on board nearly 250 passengers, most of whom were railroad people bound to the Master Car Builders' and Master Mechanics' conventions at Old Point Comfort, Va. The letter reads as follows:

"Old Point Comfort, Va., June 14, 1899.

"Dear Mr. Sinclair—You came mighty near losing your air-brake editor; but what promised for a time to be a serious disaster turned out to be merely an exciting experience.

"As arranged, I took passage Tuesday on the Old Dominion Line steamer 'Hamilton,' bound for Old Point Comfort, to attend the Master Car Builders' and Master Mechanics' conventions. There were a number of other railway and supply men and their ladies on board, similarly bound.

"We left New York on schedule time, 3 o'clock P. M., and ran into a dense fog in the lower bay. About 5 o'clock the fog lifted, and we steamed out past Sandy Hook. Then the fog settled densely again, necessitating slower speed.

"It was nearly 6 o'clock when I observed that the tables were being set, and I went to my stateroom to prepare for dinner. While there, I heard, somewhere off in the fog, the sound of a whistle, which was answered by our whistle. I listened for a moment to this communication of fog signals, then stepped out on the upper deck to see the passing of the stranger, whoever she might be. Just then her whistle sounded again, and gave

THE "JACKIES" AT WORK.

THE HOLE IN THE "HAMILTON'S" BOW.

one the direction whence he might expect her to appear. This direction seemed almost straight ahead.

"Sure enough, it was straight ahead, and there, through the fog, I could see a huge, dark, spectral object gradually, though quickly, change from a ghostly fog-picture into the substantial form of an ocean steamship. She was less than two ship-lengths off, and bearing down upon us, almost head on, at what seemed frightful speed. At first it looked as though we might pass, scraping port sides.

"'Great Scott!' I thought. 'What if we were to collide head on at that speed! It's lucky we'll get nothing worse than a side scrape!'

"'Holy Moses!' I exclaimed, as I saw that the stranger, instead of holding her course and steering off to starboard, was heroes don't have any fun, anyhow, and no glory, except in stories. But here I stood on the upper deck of an ocean steamship, several miles from land, clinging to the hand-rail, and possessed with an indescribable desire to jump, realizing that there was no place to alight, and that to jump might be worse than staying where I was.

"I must stay! The darkey's logical presentation of the advantage of being in a railroad wreck over a shipwreck whizzed through my mind—'In a railroad wreck, you is on land, an' dar you is; in a shipwreck, whar is you?' I missed the hiss of the cylinder cocks of the locomotive, with the reverse lever in the back motion. How deep was the water? Would the tops of the masts reach above the surface of the water with the hull lying on the bottom? How far were we from far over to starboard from the force of the blow. I thought at first that we would upset and then that we would never right again.

"'Conger or some other fellow will have to do the air-brake department this month, sure, I thought as the deck of the tipping vessel stood about thirty degrees from the horizontal. But as she righted up again to her normal position, I felt that we would not sink, and that my chances for going on with the work were pretty fair.

"I rushed around on the starboard side and saw that the ship we had collided with was the 'Macedonia,' and that we had half cut her in two. Some of her crew hastily clambered aboard the 'Hamilton,' while the others lowered two boats into which they jumped and shoved off from the sinking vessel.

"As we backed off, a huge hole showed

PASSENGERS ON "HAMILTON."

LIFE PRESERVERS IN DEMAND.

actually turning to port and attempting to cut across our bow. 'Somebody's name's Dennis!'

"It was not difficult to see that a collision was now inevitable and beyond the power of man to avert.

"Several times during my five short, though busy, years' experience on the ninety-three miles of rough, foggy, hilly, and then single-track road lying between Dennison and Pittsburgh, have I looked into the bright, staring eye of the other fellow's engine, as she came, bigger than a mountain, head on, into us. Many more times have I watched, on this same old Pan Handle road, the red deck lights of the caboose ahead grow from tiny scarlet spots into bigger and redder suns than ever rose east of Cadiz or set west of Mingo. It was part of my religion, and one always lived up to, to always jump off instead of riding into a collision. Dead land? Would a life-preserver float a woman with heavy skirts? Would the boilers blow up in the collision? Would it be long before a passing ship would pick up the survivors? Would both ships be sunk? Would we be caught and crushed in the collision like men frequently are in a railroad wreck? Would the sound of the crash be like that in a railroad collision? All this flashed through my mind as I stood, clutching the rail, waiting and watching for the two big ships to come together.

"It came at last, after an age of suspense. There was a fearful shock which nearly knocked me off my feet, followed by a terrific grinding and groaning of torn steel plates and beams. In the excitement of the moment I could plainly hear the crash of the dishes in the dining saloon and the screams of the women and children. The 'Hamilton' careened in the 'Macedonia's' starboard side large enough to put in a freight car sideways, and one almost as large in the bow of the 'Hamilton.' Our captain immediately headed his ship for shore and ordered the boats swung down in the davits. This caused a panic among some of the women, who, with a number of the men, hastily put on life preservers. I rushed to my state room to get my camera and take a picture of the 'Macedonia' before she sank. Coming out I was met by a woman who asked for a life preserver. I fished out one from under the berth, gave it to her, stopped long enough to see that she got it fastened on, then went to take my picture; but the 'Macedonia' had almost disappeared in the dense fog. I then proceeded to take some pictures of scenes on board. In this I was severely criticised by some women in life preservers, who made several uncomplimentary remarks

about your air-brake editor, with especial reference to his lack of good sense. 'He ought to be praying,' said one woman, 'instead of running around like a darn fool with that kodak.'

"But our ship didn't sink, as some thought it would. The hole in her bow only affected her forward compartment, and we put back to New York. The 'Hamilton' going up the bay must have looked like a huge fish with its mouth open.

"The passengers were given their choice of having their tickets redeemed or waiting over a few hours for the next ship. A greater number redeemed their tickets and went forward by rail. A few others, of which I was one, however, waited for the next day's ship. And why shouldn't we? Lightning seldom strikes twice in the same place, and there was one less ship to take chances on.

THE "JACKIES" AFTER IT WAS OVER.

GETTING LIFEBOATS READY.

"Hoping to see you here next week, I remain yours truly F. M. NELLIS.

"P. S.—Will develop some of the pictures and send them to you."

"P. S. S.—A colored woman, as she walked down the gang-plank of the 'Hamilton' at the New York pier, shifted her oilcloth satchel from one hand to the other, took a fresh dose of snuff, looked back at the vessel and said. 'Good-bye, ol' ship! No mo' wattah fo' dis niggah! Nevah, no mo'll I trabel by ship as long as I'se black; an' I doesn't 'spect I'll turn white soon!' "

Messrs. Gould & Eberhardt send us a little folder entitled "Like This," which shows more by illustration than by descriptive matter the advantages of their automatic sand sifter and mixer. These are sent on request.

The New England Locomotive Builders

A recent visit to both the Rhode Island and the Manchester Locomotive Works showed pleasing signs of activity that spoke plainly of the improved business conditions.

The former works are rapidly getting in shape for handling their work, and the Wabash engines are under way. They are being delayed by slow delivery of material, but this will not last after they get things moving. Then they will go after orders.

The Manchester works were busy on some engines for the Bangor & Aroostook road, and are also doing quite a little business in the fire-engine line. They are building a self-propeller or "automobile" fire engine for New Orleans. This is not their first by any means, as Hartford, Conn., has used them for years (the largest one we illustrated in July, 1897), and Boston has two large ones. Their shop is well equipped with Sellers planers, and they have several machines of their own for special work. One is a milling machine in which the cutter revolves horizontally on a vertical spindle. This is for milling the rod ends. There is also a machine for turning solid crosshead pins, which is an improvement over the usual fixture for this purpose. Details of this may be obtained later.

The National Exposition.

The National Export Exposition, to be held in Philadelphia, from September 14 to November 30, 1899, will occupy over 60 acres of ground. The site is one that is admirably adapted for exposition purposes as it is within ten minutes' ride of the City Hall and very close to the depots and stations of all the large railroads which run into the city.

From the South street entrance the esplanade will lead directly up to the imposing front of the main building. The esplanade, which is to contain all the amusement features connected with the Exposition, is 800 feet long and 250 feet wide, and on either side will be erected buildings which will be both unique and ornate. Among the many special features of the esplanade will be a Chinese village peopled by 400 natives of China. There will be many novelties displayed on the esplanade, amusing, interesting and instructive.

A broad driveway will skirt the main building. This massive structure, 1,000 feet long and 400 feet wide, will be decorated with statuary and at night will be brilliantly illuminated. On one side of this building will be located a checking station for bicycles with a capacity for 10,000 wheels. A spacious promenade dotted with Japanese pagodas, containing rustic benches, will encircle the main building. Wide walks will lead from this to detached structures containing special exhibits.

The power house, a structure built of stone, 58 by 190 feet in size, is situated on the river side of the grounds, between the central and southern pavilions of the main building. It has a flat roof which will be utilized as a roof garden.

The transportation building is 450 feet in length and tracks from the Pennsylvania Railroad will lead into the building.

The Chicago, Rock Island & Pacific Railway people are noted for the careful way they roll all the journals of locomotives before putting them into service. They calculate that the rolling process is as good as 1,000 miles of running for reducing the journal to a smooth running surface.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Recently Patented Air-Brake System.

A patent for an air-brake system for railway trains has been granted to J. F. Voorhees, of Philadelphia, Pa.

The system, which is illustrated herewith, is of the double pipe kind, and the claims made for it are that the engineer may vary the braking force at will.

In the drawings, Fig. 1 represents an elevation of the parts of an ordinary automatic brake apparatus for conveying pressure from the locomotive to the car-brake cylinders, shown in connection with a quick-acting system of automatic relief valves, controlled by an engineer from a locomotive. Fig. 2 is a longitudinal section through the relief valve *R*, showing also its relation to the brake cylinder. Fig. 3 is a longitudinal section through a pressure-retaining valve. Fig. 4 is a plan view, partially in section, of the engineer's valve *M*; and Fig. 5 is an end view of the car brake appliance, Fig. 1, below the train pipes.

A represents a storage reservoir at the locomotive; *B*, a supply pipe; *C*, an engineer's brake valve; *D*, the main train pipe; *E*, a branch therefrom; *F*, a triple valve; *G*, an auxiliary reservoir; *H*, a brake cylinder; *I*, a brake pipe connecting the triple valve and the brake cylinder. These parts are usually provided.

The parts which have been added are a reducing valve *K*, conveniently limiting the amount of pressure admitted to a pipe *L*, connecting the storage reservoir with a valve *M*, manipulated by the engineer and regulating a pressure in a retaining pipe *O*, extending throughout a train and connected by a hose and coupling between the cars. A gage *N* indicates a pressure in the pipe *O*, and a branch pipe *P* connects the same with an automatic relief valve *R*, joined directly to the brake cylinder *H*. A retaining valve *Q* is interposed between the exhaust port of the triple valve *F* and the retaining pipe.

One compartment of the valve *R* being in constant communication with the brake cylinder and the other with the engineer's valve *M* and the actuating diaphragm interposed immediately between them and the relief valve capable of releasing the pressure as rapidly as admitted to the brake cylinder, enables the engineer, according to the pressure he admits into the pipe *O* through the valve *M*, to predetermine the maximum force with which the brakes can be automatically applied, from the fact that pressure permitted to enter the brake cylinders that otherwise cause an accumulation of pressure therein exceeding the desired amount escapes immediately to the atmosphere through the valve seat R^2 as rapidly as it can enter the brake cylinder, and he can from the locomotive limit the force with which the brakes can be applied when he is otherwise deprived of any control of their action, according to the probable resistance to said action, and he is also enabled to release the braking force exceeding an amount determined by the resistance of the spring R^3 by releasing the retaining pressure in the pipe *O* through the valve *M* with a control similar to that obtained by using the direct-acting system, but with greater rapidity in the reduction of braking force, from the fact that the pressure so released passes immediately to the atmosphere at the valve seat R^2, and also that a specific reduction of pressure in the pipe *O* releases a proportionately greater amount of pressure from the brake cylinder, thereby enabling the extra braking force to be released with sufficient rapidity as to render its employment practicable.

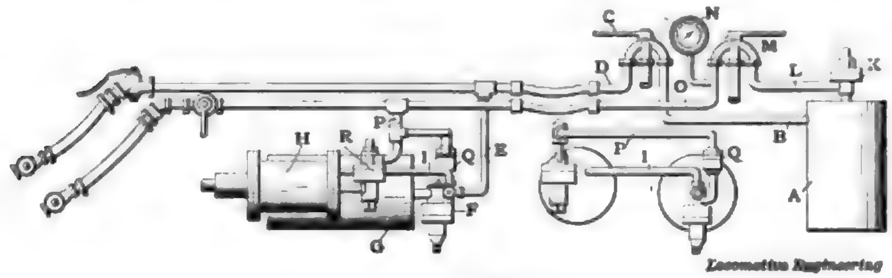


Fig. 1

The retaining valve, Fig. 3, connected to the exhaust port of the triple valve by the pipe P^2 and with the pipe *P* by the pipe *P'*, is provided for the purpose of retaining pressure in the brake cylinder *H* while recharging the auxiliary reservoir from the main train pipe by pressure in the same pipe employed for conveying the retaining pressure to the valve *R*.

The valve Q^2 when seated presents a greater exposed area to pressure from the pipe *O*, and it will require but slight pressure therein to retain the full amount of pressure released through the triple valve when recharging the auxiliary reservoir from the main train pipe, and when the pressure in the pipe *O* is reduced to a minimum the pressure released from the brake cylinder through the triple valve will be enabled to unseat the valve Q^2 and equalize with the pressure in the pipe *O*, and will be somewhat reduced by expansion therein before it is released to the atmosphere, and as the pressure thus created in the pipe *O* acts as a retaining force at the valve *R*, the full amount of pressure should not be retained in the brake cylinder until the auxiliary reservoir was fully recharged unless an amount of braking force so determined can be advantageously employed.

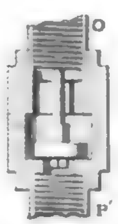


Fig. 3

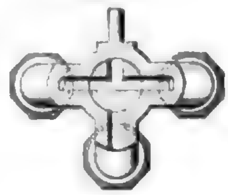


Fig. 4

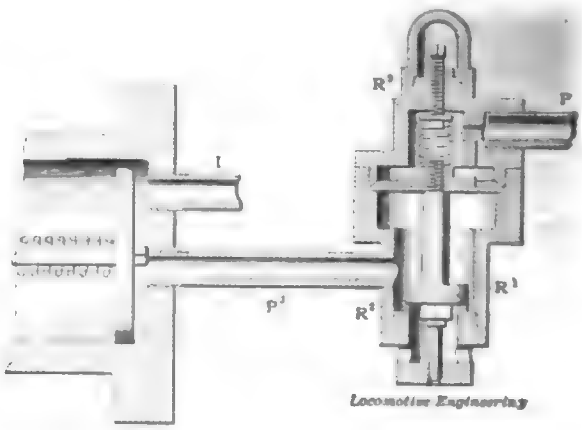


Fig. 2

A Real Brake Failure and a Moral.

The nature of the air brake is such that evil communications corrupt its manners. This is fundamental. Consequently an excellent air brake makes a weak missionary. This is illustrated by an accident which lately happened.

The train consisted of a locomotive, twenty-five loaded freight cars and a caboose. The four cars next to the locomotive were equipped with air brakes, that nearest the engine having a brake made by one air-brake company and the three next following being equipped with the brake of another air-brake company. The engineman found that even a very light reduction of the train-pipe air pressure for a service application caused a quick action application of all. But with careful handling of the slack of the train, this quick action application was kept from doing injury to draft gear. But finally the train parted between the eleventh and twelfth cars. The engineman gave the proper whistle signal and moved on out of the way of the rear end of the train. The rear portion was stopped by the hand brakes, and a second section of the train, which followed, was stopped so that the locomotive stood some 40 or 50 feet behind the caboose of the first section.

The engineman of the first section backed the forward portion of his train, and upon nearing the rear portion he applied the air brakes with a light reduction of train-pipe air pressure. As in previous applications, this resulted in an emergency application of the brakes, which caused the train to part between the fourth and fifth cars—that is, between the last air-brake car and the first non-air-brake car. The seven non-air-brake cars continued to move on with considerable speed and collided with the rear portion of the train. The force of the collision was sufficient to start the rear portion in motion, which caused a second collision with the locomotive of the second section. The result of these two collisions was that four drawheads were broken, together with the bumper beam and headlight of the locomotive of the second section. The brake beam upon the caboose was broken and the rear axle was sprung so that the rear wheels of the caboose had to be slid to the terminal, seventeen miles distant.

An examination of the brakes showed that their severe operation was entirely due to the single break on the car next to the locomotive, which was susceptible of a service application, but invariably caused an emergency application of all the cars in operation, regardless of the most careful manipulation by the engineer.

We are not going to point the moral, but it seems too obvious.—*Railroad Gazette.*

FIG. 1. EXTERIOR VIEW OF "THE NICKEL PLATE'S" AIR-BRAKE INSTRUCTION CAR.

Synnestvedt's "Air-Brake Diseases."

"Air-Brake Diseases" is the name Mr. Paul Synnestvedt gives the revised edition of his "Diseases of the Air-Brake System" to distinguish the new from the old. The author makes no weakening apologies for his first book in introducing his latest, as authors frequently do, but plainly and sensibly states his desire to bring up to date a book which has now been on the market four years. The original text has been rearranged and considerable new matter added, including an introductory chapter of elementary character, a chapter on recent apparatus not treated in the "Diseases of the Air-Brake System," and an appendix on train signal diseases. The price of the book remains the same, $1. "Diagnose your case, then apply the remedy," and "Use reason first and hands afterwards" are phrases originally coined by Mr. Synnestvedt and will always be good air-brake philosophy. His book is a valuable addition to all air-brake libraries.

Instruction Car Kink.

In the Chesapeake & Ohio Railway air-brake car the sectional 8-inch air pump that is used for explanation to the class is hung on long solid hinges to the side of the car so it swings out like a door. When in use it is swung out into the car so that the class can see every side of it as well as gather round it. When not in use it is up against the side of the car out of the way. Mr. W. P. Huntley, instructor, is the designer of this kink.

The Westinghouse Air Brake Abroad.

A contemporary writes truthfully of the Westinghouse air brake as follows:

"Not only has the Westinghouse air brake become the standard for American railways, but its adoption by foreign countries is having a rapid growth. For several years the Westinghouse Brake Company, Limited, has been established in London, Paris and Hanover, and more recently manufacturing works have been established at Hamilton, Canada. The superiority of the Westinghouse air brake over all others has led to its quite general adoption in Europe. A large majority of European passenger trains are already equipped with it.

"Until recently comparatively little progress had been made in the Old World in the way of control of freight trains by the air brake. The application to freight cars in Europe is now receiving an impetus by the decision on the part of the government railways of Russia to equip and operate freight trains with the Westinghouse air brake. In view of the very considerable amount of business promised by this new departure in Russia a new air brake company, the Societe Anonyme Westinghouse, has been established, and is now equipping a manufacturing plant in St. Petersburg. Contracts have already been placed by the Russian Government with this new Westinghouse company for $2,000,000 worth of apparatus, which will keep the Russian plant busy for some time to come, and even larger contracts by the Russian Government are to follow.

"Before the Russian Government decided upon the application of Westinghouse air brakes to the government railways careful investigation was made of the merits of the brake apparatus manufactured by different makers. At a recent meeting the Government engineers and experts decided that the Westinghouse air brake is superior to all others, and that the Russian Government railways should be equipped with it. This action on the part of the Russian railways will no doubt be followed by other European railways in the application of air brakes to freight cars, and it now seems that the day is not very remote when all trains, passenger and freight, throughout the civilized world will be under the control of the air brake, which will ever remain a monument to the ingenious Westinghouse."

FIG. 2. AN INTERIOR VIEW OF "THE NICKEL PLATE'S" INSTRUCTION CAR.

FIG. 3. ANOTHER INTERIOR VIEW OF "THE NICKEL PLATE'S" INSTRUCTION CAR.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(44) J. W., Duluth, Minn., asks:

Why is it necessary to put a gage on driver brake cylinders to accurately determine the travel to be given pistons? A.—In some instances in the past auxiliary reservoirs were not so well proportioned to the brake cylinders of locomotives as they now are and have been on cars. Another reason is that the length of piping necessary to reach from the triple valve to both driver brake cylinders varies so greatly in length on different locomotives that 50 pounds cannot be had at the same stroke of all pistons. Hence the use of the gage.

(45) A. J. L., Syracuse, N. Y., writes:

In your report of the Air-Brake Association's Detroit meeting, which you gave in May number of LOCOMOTIVE ENGINEERING, you speak of independent driver brakes. I have understood that independent driver brakes were condemned, and continuous driver brakes only were allowed. How is this? A.—The independent attachment in question is a device for holding the driver brakes on after the train brakes are released. Sometimes the ordinary retaining valve is used, and on some engines a cock is put in a pipe screwed into the exhaust port of the triple. The form of driver brake which applies independently of the train brakes is condemned and should not be used. See item on page 223.

(46) J. W., Duluth, Minn., asks:

Why is the engineer's brake valve reservoir supplied by two small ports in rotary instead of one? A.—There are two ports, the preliminary exhaust port and the equalizing port, through the rotary valve seat to the chamber D above the piston.

The function of the preliminary exhaust port is to let the air pressure from above the piston at a certain rate, which must not be increased, else the piston will rise too quickly, allowing the pressure to escape from the train pipe too suddenly, and thereby cause quick action. Therefore, this port must be there, and must be limited in size. However, when brakes are released, pressure must be supplied to the top of the equalizing piston in sufficient quantity to hold it down and prevent it from rising and wasting pressure at the train pipe exhaust. But as the preliminary exhaust port is limited in size and is too small to admit pressure sufficiently rapid to hold the piston down, another port must be added to assist; hence the equalizing port.

(47) Z. V. P., Concord, N. H., asks:

What causes the governor to blow back by the diaphragm valve seat when there looks to be a good seat on both. Sometimes the governer blows back from 10 to 15 pounds before it stops. It seems to work all right otherwise. What will remedy the trouble? A.—1. We infer that the blowing back referred to is through the small port in the neck of the diaphragm body 62, and that the pump fails to shut off until the air pressure falls 10 or 15 pounds below what the governor is set for. The trouble is probably due to the shortening of the diaphragm pin valve, caused by too much grinding. 2. What is the distance from diaphragm seat in body 62 to valve seat, and what is the distance from diaphragm to seat on valve? A.—2. The better way to maintain proper lengths and distances of these parts, in the governor, is not to trust to measurements, but to get a new governor and make a steel template which shall give the distances and lengths. Allowance must be made for seats that have been ground deep into the body 62.

MODEL AIR-BRAKE INSTRUCTION ROOM OF CHICAGO & NORTHWESTERN RAILWAY, AT EAGLE GROVE, IOWA.

(48) W. A. G., Farnham, N. S., writes:

In starting out with five passenger cars equipped with the Westinghouse brake, I find that when the engineer applies the brakes they go on in emergency. I then take on five more cars, and I find that the air brake works all right. What was the trouble, and what was the reason that it did not work the same on ten cars as on five? A.—When triple valves get dirty or need oiling, they do not respond smoothly and accurately to reductions in the train-pipe pressure, but hang back and work jerky. The more quickly a certain amount of reduction is made in the train pipe, the greater is the tendency for the triples to go into quick action. This tendency is also increased by neglected conditions of the triples. As it takes less time to draw a given amount of air pressure from the train pipe of five cars than ten, the tendency to get quick action is greater on the shorter train. By adding on cars you decrease the tendency, and even get beyond it. A broken graduating spring would also cause this, but is less frequently the fault than the one given above.

(49) J. A. S., Creston, Iowa, writes:

Suppose a freight triple valve, plate F-36, were to have the feed groove in the cylinder of the proper dimension, and the groove in the piston were to be increased to dimension as intended for a passenger triple valve. What effect would this have on the proper action of the valve, and under what service would this valve be defective. I have always considered the feed groove in the cylinder the controlling groove. A.—With such a change, the triple would charge the auxiliary reservoir more quickly, and especially so if the feed port in the cylinder were large and clear and the packing ring worn. Until a few years ago, the time of charging the auxiliary reservoirs did not receive the attention it now does. Up to that time the

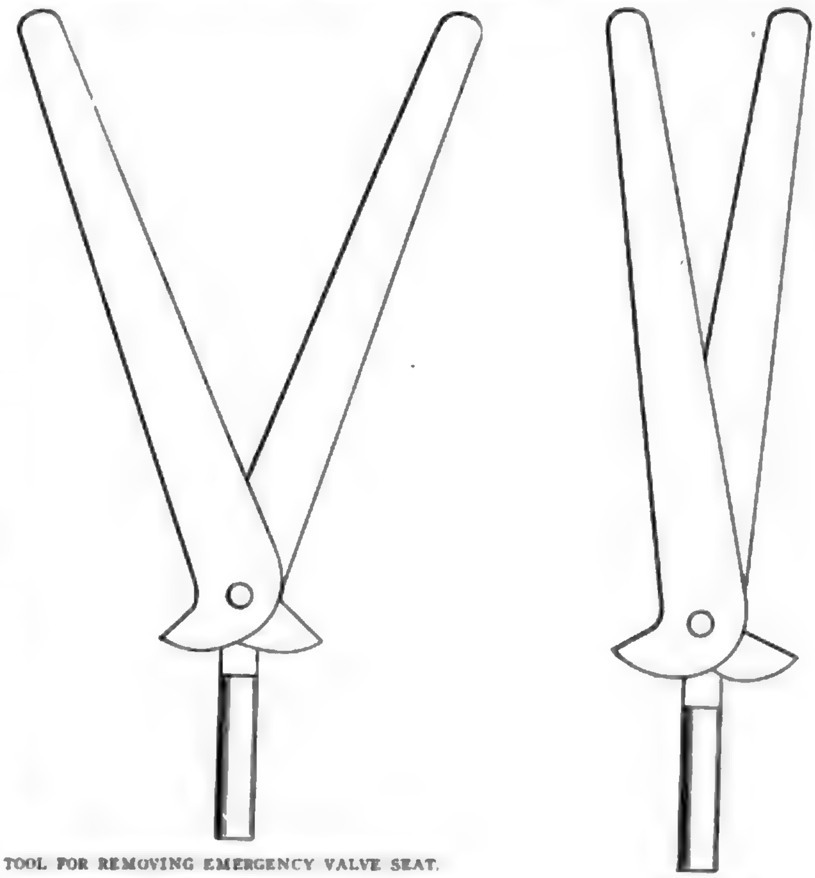
groove in the cylinder was the controlling groove, and the groove in the trunk of the piston was merely a conduit. Experience proved, however, that the groove in the trunk would be the better controlling groove, as that would not be affected by time and wear, while, on the other hand, the feed through the groove in the cylinder would be augmented by that past the worn packing ring. Hence the change was made that the groove in the trunk or stem should be the controlling groove.

(50) J. F. B., Louisville, Ky., writes:

Please inform me as to the cause of the air brakes under one of our baggage cars not working. The brake will set when applied from the engine, but will whistle off without being released by the engineer. The air will blow through the release port; and by pressing the thumb over the release port, the brake will set. And when the thumb is removed, the brake will whistle off. I thought at first the triple valve was dirty, and took it down, cleaned it, and put it back, but it acted in the same manner. I took a triple valve off one of our coaches that was working all right and tried it on this baggage car, but it had the same trouble—would whistle off without being released from the engine. I also tried two new triple valves and had the same trouble. I took the first triple valve that came off the baggage car and tried it on the coach, and it worked all right. I then tried it on the baggage car again; but it would whistle off without being released from the engine. I have had a good deal of experience with air brakes, but will admit that I am at my rope's end in this case. A.—Your experience in changing the triple valves about, proves that all the triples work all right elsewhere than on this car, and that none of the triples will work on this car. This experience indicates that the trouble lies in the baggage car, and points to a leaky triple valve gasket, between the triple and brake cylinder head, or to a sand hole or other place of leakage in the wall of the casting which separates the auxiliary reservoir pressure from the brake-cylinder pressure. If you wish to experiment further to confirm this belief, change the gasket. If the trouble does not disappear, then change the cylinder head.

(51) M. A. C., Susquehanna, Pa., writes:

I am a fireman and a subscriber to your journal, and I will ask the following questions: I am quite a heavy smoker, and when my pipe gets strong I first blow it out with the cylinder cock and then blow it out under the cock in the auxiliary reservoir, and find it invariably fills the bowl of the pipe with ice. When the Westinghouse instruction car was here, some of those teachers told me that on some of the railroads in the Western country they kindled fires on their engines with an air blower, made in the shape of a pitchfork. It was all hollow, of course; the hose being attached to the handle, and the air would pass down through holes in the tines. The supposition was that in passing out by such a small hole it became heated, and ignited; and there being some greasy waste put just under the coal, the blast got that burning and that set the coal burning in a short time. Of course, fire was first started with a match or torch; but what I am wondering about is this: if ice would form, there could not be any fire. Now, if it will form on air passing through the cock in auxiliary, why will it not form passing through this blower that they tell about? If you will kindly explain, you will greatly oblige. A.—Air will naturally heat when compressed, and will cool when released from compression.



TOOL FOR REMOVING EMERGENCY VALVE SEAT.

POSITION 1. POSITION 2.

Your experience in releasing air from the auxiliary reservoir at the release cock proves this latter statement. The fire kindler mentioned merely furnishes draft to fan the ignited oily waste into a larger and stronger blaze, which finally ignites the coal. The air does not heat, but cools instead, as it passes from the small holes in the device mentioned. Although cool, the released air nevertheless serves its purpose of fanning the blaze, and it is possible that you may find ice around the small openings even while the blaze is being fanned.

(52) W. P. A., Dennison, Ohio, writes:

After careful study on question No. 23 in March number of LOCOMOTIVE ENGINEERING, relative to the back leakage of brake cylinder pressure through the check valve in the triple, and not being able to understand your explanation regarding the same, I address you, asking this question, hoping to receive a satisfactory reply: If this train were charged to 70 pounds, and, after a reduction of 20 pounds and brake valve on lap, the pressure in equalizing reservoir would then be 50 pounds (which is about as high pressure as an auxiliary will raise a pressure in the cylinder at a full service application), why is it that this 50 pounds in equalizing chamber D will not seat equalizing discharge valve immediately after pressure equalizes or before train pipe is empty? Now, as I understand it, if all check valves were leaking, the train pipe pressure could not be raised above equalizing pressure, assuming that all joints and pipes were perfect in the equalizing reservoir and chamber D. A.—To more perfectly illustrate the point in question, we will take two cases. The first case shall be an ideal one, where there is absolutely no leakage from chamber D and the equalizing reservoir, nor from the check valves in the triples, and the piston travel on all cars shall be adjusted to give 50 pounds in brake cylinders with 20 pounds reduction. After charging to 70 pounds we will make a 20 pounds reduction. The equalizing piston will rise, let 20 pounds escape from the train pipe, and then seat. This operation has been perfect and will cause to be left 50 pounds in

chamber D and equalizing reservoir, brake cylinder, auxiliary reservoir and train pipe. The second case shall be one frequently found in practice. Chamber D and all equalizing reservoir connections shall be tight, with the exception that the packing ring in the equalizing piston is not absolutely tight. The piston travel shall be adjusted on the several cars, ranging from 4 to 9 inches, and the check valves in the triples shall leak. After charging up to 70 pounds, we will make a 20 pounds reduction in chamber D. The equalizing piston rises, lets out nearly 20 pounds from the train pipe, then begins to descend. The brake cylinder pressure on the short piston travel cars is at this instant higher than 50 pounds and is leaking into the train pipe. The equalizing piston cannot seat tightly, but allows this leakage to pass out as the pressure on the under side of the piston is still greater than that above it. Finally, equalization is reached between the two pressures; but it is reached so slowly and gradually that the piston remains hung, and pressure from chamber D will pass the packing ring, join the leakage from the cylinders and pass out. After a long while the long-travel cars begin to leak into the train pipe, and it is possible to leak it all out.

CORRESPONDENCE.

A Model Air-Brake Room.

Editor:

The photograph on page 329 represents a model air-brake room for the purpose of air-brake instruction and demonstration and air-brake repairs.

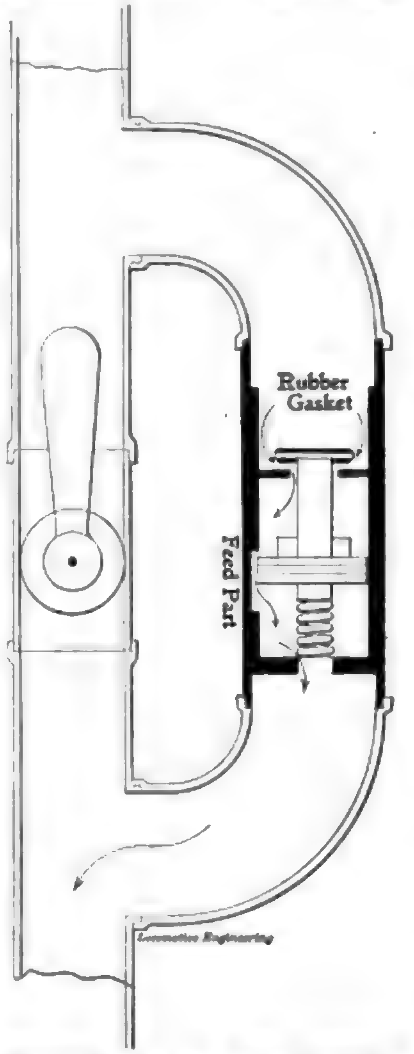
The apparatus, located on one side of the room, consists of, first, one driver brake, complete; second, two engineer's valves, one D-8 and one F-6, each having gages attached, and each having an equalizing reservoir located between the valve and wall, making it very compact; third, one tender brake, duplex gage attached, with sectional triple valve working tandem with triple of this brake; fourth, one 10-inch passenger cylinder and auxiliary with an adjustable travel from 2 to 12 inches, with duplex gage attached to show the different equalizations at different travels (the cylinder is located near the floor, and above it is a 5 x 5-foot blackboard for noting equalizations and writing new questions which are always coming up); fifth, four freight car brakes, with retainers attached (the pistons are blocked at 8 inches; gages on first and fourth car); sixth, two frames for testing air pumps and breaking them in, only one pump being visible.

Full train-pipe volume is contained in pipes which are located, with graceful bends, near the top of the room, enabling the class to trace the air with little difficulty. The main reservoir is located above the driver brake.

The passenger equipment has a six-car signal apparatus, with pipes located above train brake pipe, and car discharge valves on first, third and sixth car. The whole apparatus is painted according to the Desoe color chart furnished by LOCOMOTIVE ENGINEERING.

Sectional parts of triple valves, governor, lubricator, injector, reducing valve and signal whistle are used also.

The opposite side of the room is for repairs, and contains a good bench, with two drawers and vises, a repair table, a gage tester, a rack for repaired apparatus, a good clothes cupboard, and, best of all, a complete set of air-brake repair tools. An air blower is suspended by weights above the bench, and can be pulled down and be used for blowing out ports, etc.



PROPOSED VALVE FOR SECOND ENGINE ON DOUBLE-HEAD TRAIN.

Through a mistake of the photographer, the picture was taken from the wrong end of the room, and the gages do not show. A liberal amount of gages are used, and all of them are visible to the instructor and class, who are seated in front of bench during instruction.

This room is located at Eagle Grove, Ia., a division point of the Chicago & Northwestern Railway. It is the only plant of its kind on the system outside of the instruction car for the road.

The equipment of this room is the work of Mr. L. M. Carlton, who has charge of the air-brake department of this place, and whose endeavors, with the officials' assistance, have built up a good air-brake service. It shows what a railroad can do for its employés if it only will.

T. B. HEDDON,
C. & N. W. Ry.

Eagle Grove, Ia.

Valve to Permit Double-Heading Engines to Recharge Simultaneously.

Editor:

I have made a little sketch of a valve connected above and below the cut-out cock under engineer's valve. Now, why will this not do? When second engine cut-out cock is turned, air goes through this valve and a small spring at bottom to hold a little more than the weight of the valve. When the front engineer reduces pressure the pressure above the large piston will push the piston down and seat the top valve, which has a rubber gasket on under side, shutting off pressure from second engineer's valve.

When brakes are released the pressure on the under side of the large piston will raise it and top valve off its seat, letting the air from second engine's reservoir through the brake valve and the small groove around the piston to the train pipe. Should the valve be pushed clear up, the small groove on the left is longer than the piston when clear down; so pressure on the top of the piston will be the same as below, and an increase of pressure will raise the valve.

WM. H. ROBERTS.

Cincinnati, Ohio.

Tool for Removing Emergency Valve Seat.

Editor:

The tool sent herewith is for removing the emergency-valve seat when it becomes stuck fast by the rubber gasket and cannot be removed by the hand. To apply, the long ends of levers should be spread apart, as shown in Fig. 1, till short ends come against the shoulders on fulcrum post. This then enables the instrument to be put in position without any part striking the valve seat, and fulcrum post bearing up against emergency piston in the space occupied by emergency valve stem.

The long ends of levers then being drawn together by the hand, as shown in Fig. 2, the short ends come against the seat, which can then be removed without trouble, or injury to the gasket.

The levers or handles should under no circumstances be hammered, as the tool would not only be injured, but the emergency piston and its guide would also suffer. There is sufficient power in the hand, with the amount of leverage in the tool to remove the seat, no matter how badly stuck.

The short ends of levers are made long enough to go beyond the web of piston

guide. This was found necessary, as the part of seat against which the tool bears, which usually has a square corner, has been beveled off in the triples of Canadian manufacture, causing the tool shown in the Air-Brake Men's Proceedings to slip; while with this tool the bevel edge will make no difference, as it reaches beyond, and will act equally well on either kind of seat. Its inexpensiveness and simplicity are apparent.

C. R. ORD,
A. B. Insp., Can. Pac. Ry.
Toronto, Can.

Quarrel Over the Message to Garcia.

Some months ago there appeared in the *Philistine* an admirable article called "A Message to Garcia." Mr. George H. Daniels, the enterprising general passenger agent of the New York Central, thought the article so good that he had 100,000 of it circulated. The following extract will indicate the kind of reading the letter provided:

"My heart goes out to the man who does his work when the 'boss' is away as well as when he is at home. And the man who, when given a letter for Garcia, quietly takes the missive, without asking any idiotic questions, and with no lurking intention of chucking it into the nearest sewer, or of doing aught else but deliver it, never gets 'laid off,' or has to go on a strike for higher wages. Civilization is one long, anxious search for just such individuals. Anything such a man asks shall be granted; his kind is so rare that no employer can afford to let him go. He is wanted in every city, town and village—in every office, shop, store and factory. The world cries out for such; he is needed and needed badly—the man who can carry a message to Garcia."

Mr. George H. Heafford, the general passenger agent of the Chicago, Milwaukee & St. Paul, did not enjoy the "Message to Garcia," and published his views thereon, in which he calls the letter a gratuitous insult even to the lowest average of intelligence and ability of the American employé in any office, shop or workroom in this country—a libel on every class of American wage-workers, and so on.

Meanwhile, there is a pretty quarrel on between two giant advertisers; but it is certain that in the controversy the interests of the respective roads represented by the combatants will not be overlooked.

It is reported that the Rhode Island Locomotive Works, which are building locomotives again, have received an order to build 1,000 trucks for the New York Auto-Truck Company.

A never omitted item of the bill of fare at Old Point Comfort was little neck clams. The Western men called them "rubber gaskets."

EQUIPMENT NOTES.

The Chicago, Burlington & Quincy Railroad will build, at their Aurora shops, 200 furniture cars.

The Egyptian State Railways have ordered 200 more steel cars from the Pressed Steel Car Company.

The Peoria & Pekin Terminal has ordered fifty coal cars from the Illinois Car & Equipment Company.

The Baldwin Locomotive Works are building ten consolidation locomotives for the Pennsylvania Railroad.

The Chesapeake & Ohio Railway are having fifteen locomotives built by the Richmond Locomotive Works.

The Houston, East & West Texas Railway have ordered fifty box cars from the Pullman Palace Car Company.

The Atlas Cement Company have ordered two four-wheel locomotives from the Rogers Locomotive Works.

The Cincinnati, Hamilton & Dayton Railway have placed an order with Barney & Smith Company for 200 cars.

The Erie Railroad have placed an order for fourteen Atlantic type locomotives with the Baldwin Locomotive Works.

The Chicago, Burlington & Quincy Railroad are having fifteen locomotives built at the Baldwin Locomotive Works.

The Southern Railway Company are having seven consolidation locomotives built by the Pittsburgh Locomotive Works.

The Barney & Smith Company have received an order for 100 cars for the St. Joseph, South Bend & Southern Railroad.

The Brooks Locomotive Works have received an order for four switching locomotives from the Great Northern Railway.

Brooks Locomotive Works have received an order for ten twelve-wheel locomotives from the Central Railroad of New Jersey.

The Mississippi River & Bonne Terre Railway have ordered one consolidation locomotive from the Richmond Locomotive Works.

The Baldwin Locomotive Works are to build two six-wheel connected locomotives for the Vicksburg, Shreveport & Pacific Railroad.

The Mississippi & Bonne Terre Railway are having 100 cars built by the American Car & Foundry Company at their St. Charles works.

The Central New York & Western Railroad have placed an order for two consolidation locomotives with the Pittsburgh Locomotive Works.

The American Car & Foundry Company, at their Depew shops, are building 500 cars for the Buffalo, St. Mary's & Southwestern Railroad.

The Pittsburgh Locomotive Works have received an order for one six-wheel connected locomotive for the Cleveland Terminal & Valley Railroad.

We understand that the Port Talbot Railway & Docks Company, of England, have ordered six locomotives from the Cooke Locomotive & Machine Works.

Waste Instead of Water.

In a letter I wrote to LOCOMOTIVE ENGINEERING last month, the word "waste" was printed "water." What I meant to have said was: The condition in the cellar should approach an oil bath as near as it is possible to make it with the use of cotton waste and oil.

E. H. BELDEN.
Scranton, Pa.

Broken Eccentric Straps.

In reading the article on broken eccentric straps, on page 284, June number of LOCOMOTIVE ENGINEERING—if I broke a go-ahead eccentric strap, I would turn the back-up eccentric to go-ahead position and bolt the blades together. This will answer the same purpose as taking the strap down and turning it over and putting it on the other cam, and will also save time.

C. H. ROCKWELL.
Lincoln, Neb.

The Moran flexible joint got a fine endorsement by the Master Mechanics' Convention when "The comparative efficiency and economy of metal flexible joints versus rubber hose for steam-heating connections" was under discussion. As the Pennsylvania Railroad have this joint in use on over 1,200 locomotives, it is no longer an experiment. Many attempts have been made to render rubber hose durable under steam, but no success has been achieved. Better give in and use metal pipes with flexible joints.

The Pacific Coast Railway Club have favored us with the first issue of their official proceedings. While the first meeting was of necessity a preliminary one they appear to have got down to business, and the June paper was "Railroading As We See It," by members of the committee. We wish them all kinds of good luck and hope to be with them some of these days.

We are informed by the Buffalo Forge Company that the 16-inch center crank engine which won the gold medal for high-speed engines at the Omaha Exposition, has been purchased by the Bowery Bay Building & Improvement Company, North Beach, L. I. This engine ran at 250 revolutions per minute, developing 279 horse-power, and is one of their type which runs in oil.

The Baldwin Locomotive Works have received an order for locomotives for a railroad in Palestine.

PERSONAL.

Mr. T. E. Harwell has been appointed master mechanic of the Southern Railway at Mobile, Ala.

Mr. E. W. Peck has been appointed trainmaster of the second district of the Baltimore & Ohio.

Mr. G. W. Spencer has been appointed trainmaster of the third district of the Baltimore & Ohio.

Mr. C. F. Newton has been appointed superintendent of the Tennessee Central, with headquarters at Rockwood, Tenn.

Mr. T. G. Shaughnessy, vice-president of the Canadian Pacific, has been elected president, vice Sir William Van Horne, resigned.

Mr. John Dearden has been appointed locomotive foreman of the Canadian Pacific at Brownville Junction, vice Mr. C. H. Small, resigned.

Mr. James Denison, of Newark, Ohio, has been appointed traveling engineer from Chicago to Akron on the Baltimore & Ohio Railroad.

Mr. M. T. Phillips, general foreman of the St. Louis & Hannibal, has been promoted to the position of master mechanic; headquarters at Hannibal, Mo.

Mr. A. McCormick has been appointed master mechanic of the Rock Island & Peoria, succeeding Mr. Joseph Elder, resigned; headquarters at Peoria, Ill.

Mr. G. T. Sanderson has been appointed master mechanic of the Montana division of the Great-Northern, vice Mr. J. McGie; headquarters at Havre, Mont.

Mr. W. H. Reilly has been appointed master mechanic of the Fort Worth & Rio Grande, in place of Mr. I. J. Shellborn, resigned; headquarters at Fort Worth, Texas.

Mr. W. H. Whalen, formerly connected with the purchasing department of the Rock Island, has been appointed purchasing agent of the Delaware, Lackawanna & Western.

Mr. Harry Muchmore has resigned the position of division foreman on the Iowa Central to accept the position of general foreman of the Santa Fé Pacific shops at Winslow, Ariz.

Mr. R. F. Kilpatrick has been appointed master mechanic of the Morris & Essex division of the Delaware, Lackawanna & Western at Kingsland, N. J., succeeding Mr. Wm. H. Lewis, resigned.

The new shops of the Gulf, Colorado & Santa Fé, at Cleburne, Texas, have been completed, and Mr. J. P. Malley, foreman of the boiler department, has been transferred from Galveston to Cleburne.

Mr. W. H. V. Rosing, mechanical engineer of the Illinois Central, has been appointed assistant superintendent of machinery, succeeding Mr. F. W. Brazier, resigned; headquarters at Chicago, Ill.

Mr. Lester I. Knapp, general foreman of the Lehigh Valley shops at Buffalo, N. Y., has been promoted to the position of master mechanic of the Buffalo division, succeeding Mr. J. S. Chambers, resigned.

Mr. M. J. Spaulding has been appointed master mechanic of the Washington County Railroad at Calais, Me. He was formerly road foreman of engines on the Atlantic Division of the Canadian Pacific.

Mr. George W. Dowe, superintendent of the Jefferson division of the Erie, has been transferred to the Allegheny division, with headquarters at Hornellsville, N. Y., succeeding Mr. H. E. Gilpin, transferred.

Mr. E. E. Loomis, superintendent of the New York, Susquehanna & Western Railroad, has resigned to become superintendent of the coal mining properties of the Delaware, Lackawanna & Western Railroad.

Mr. W. L. Stevenson, superintendent of the Kansas City Suburban Belt and Kansas City & Independence Air Line, has been appointed to the position of superintendent; headquarters at Kansas City, Mo.

Mr. Harley E. Rogers, locomotive engineer on the Atlantic division of the Canadian Pacific, has been promoted to the position of foreman of engines, left vacant by the resignation of Mr. M. J. Spaulding.

Mr. Harrison M. Messimer has been appointed master mechanic of the Ohio Southern, at Springfield, Ohio, vice Mr. H. M. Sehrt, resigned. Mr. Messimer will have charge of the motive power and equipment.

Mr. R. S. McKenna, whose father was superintendent of the Scranton shops of the Delaware, Lackawanna & Western Railroad Company, has been appointed to succeed Superintendent Baker of the Dover shops.

Mr. George W. Stevens, for over thirty years connected with the Lake Shore & Michigan Southern, and for the past six years superintendent of motive power, with headquarters at Cleveland, Ohio., has resigned.

Mr. R. O. Cumback, superintendent of motive power of the West Virginia Central & Pittsburgh, at Elkins, W. Va., has resigned to accept the position of general foreman of the Lehigh Valley shops at Buffalo, N. Y.

Mr. J. Coppersmith, one of the old engineers of the Eastern division of the Lake Shore & Michigan Southern, has been promoted to the position of traveling engineer of the same division, with headquarters at Erie, Pa.

Mr. John G. Minnice, train dispatcher on the Mobile & Ohio, has been promoted to the position of train master of the Montgomery division of that road, with headquarters at Tuscaloosa, Ala., vice Mr. W. N. Jones, promoted.

Mr. William A. Patton, assistant to the president of the Pennsylvania Railroad and vice-president of the New York, Philadelphia & Norfolk, has been elected president of the latter road, succeeding Mr. A. J. Cassatt, resigned.

Mr. George A. Kingsley has been appointed road foreman of engines on the Chicago & West Michigan and Detroit, Grand Rapids & Western; headquarters at Grand Rapids, Mich. He was heretofore with the Northern Pacific.

Mr. Thomas Fildes, master car builder of the Lake Shore & Michigan Southern, at Englewood, Ill., resigned recently, and has been appointed assistant superintendent of motive power and equipment of the Long Island Railroad.

Mr. C. C. Burnett, assistant superintendent of the Worcester division of the New York, New Haven & Hartford, has been appointed superintendent of that division, vice Mr. F. G. Spencer, resigned; headquarters at Providence, R. I.

Mr. H. E. Gilpin, superintendent of the Allegheny division of the Erie at Hornellsville, N. Y., has been appointed superintendent of the New York, Susquehanna & Western, succeeding Mr. E. E. Loomis, resigned; headquarters at Jersey City, N. J.

Mr. Frank H. Britton, superintendent of the Dakota division of the Great Northern at Larimore, N. D., has resigned to accept the position of general superintendent of the St. Louis Southwestern, at Tyler, Texas, succeeding Mr. J. A. Edson, resigned.

Mr. W. D. Cantillon, assistant division superintendent of the Chicago and Northwestern at Milwaukee, Wis., has been promoted to the position of superintendent of the Winona & St. Peter division at Winona, Minn., succeeding Mr. W. P. Cosgrave, resigned.

The resignation of Mr. J. A. Edson, for many years general superintendent of the Cotton Belt Route at Tyler, Texas, has been tendered and he has accepted the position of general manager of the Kansas City, Pittsburgh & Gulf, to succeed the late Robert Gilham.

Mr. D. C. Courtney, formerly master mechanic for the Baltimore & Ohio at Connellsville, Pa., has been appointed superintendent of motive power for the West Virginia Central & Pittsburgh; headquarters at Elkins, W. Va. He succeeds Mr. R. O. Cumback, resgined.

At a meeting of the Board of Directors of the Central Railroad of New Jersey, last month, Mr. George F. Baker was elected chairman of the executive committee, and Mr. Charles H. Warren was elected first vice-president. Mr. Warren was heretofore assistant to the president.

Mr. George Thompson has been appointed master mechanic of the Fall Brook Railway, in place of Mr. W. A. Foster,

resigned. Mr. Thompson has been for some years master mechanic of the Beech Creek Railroad, and the extended territory is an addition to his responsibilities.

Mr. A. Hendee has been appointed master mechanic of the Panama Railroad, vice Mr. Percy Webb; headquarters at Colon, Colombia. Mr. Hendee has had considerable railroad experience in Central American States. For the last few years he had been in the employ of the Westinghouse Air-Brake Company.

The following changes have been made on the Chicago & Northwestern: Mr. F. R. Pechin, assistant superintendent of the Wisconsin division, with headquarters at Milwaukee, Wis., vice Mr. W. D. Cantillon, promoted; Mr. C. E. Andrews, trainmaster, with office at Fortieth street, Chicago, vice Mr. F. R. Pechin, promoted.

Mr. John W. Cloud accepted the position of president of the Westinghouse Air-Brake Company, of Great Britain, recently, and consequently had to resign his position as secretary of the Master Mechanics' and Master Car Builders' Associations. His place has been filled by the election of his assistant, Mr. J. W. Taylor, for both associations.

Mr. Joseph H. Sands, general manager of the South Carolina & Georgia, has resigned to accept the position of superintendent of the Charleston division of the Southern Railway at Charleston, S. C. The offices of general superintendent and superintendent of motive power of the Charleston division, held by W. S. Jones and Mr. James Meehan, have been abolished.

Mr. W. F. Hallstead, second vice-president and general manager of the Delaware, Lackawanna & Western, has resigned. Mr. Hallstead entered the services of the Delaware, Lackawanna & Western in 1852 as brakeman and was promoted right along until 1886, when he was made general manager, and afterwards was chosen second vice-president. It is said that the position of general manager will be abolished.

Mr. George H. Henderson has been appointed assistant superintendent of motive power of the Chicago & Northwestern, in place of Mr. W. H. Marshall, resigned. Mr. Henderson, who is a college graduate and a mechanic of Pennsylvania training, was for years a mechanical engineer for the Norfolk & Western. A few months ago he entered the employ of the Schenectady Locomotive Works, which he leaves to go to the Chicago & Northwestern. Mr. Henderson was one of two who were under consideration when Mr. Marshall got the position of assistant superintendent of motive power on the Chicago & Northwestern two years ago.

Mr. Waldo H. Marshall, assistant superintendent of motive power of the Chicago & Northwestern, has resigned to accept the position of superintendent of motive power of the Lake Shore & Michigan Southern, succeeding Mr. G. W. Stevens, resigned; headquarters at Cleveland, Ohio. The position of master car builder, made vacan by the resignation of Mr. A. M. Waitt, has been consolidated with that of superintendent of motive power, and Mr. Marshall will have charge of both departments. Mr. Marshall was formerly editor of the *American Engineer, Car Builder and Railroad Journal*, and left that position about two years ago to go with the Chicago & Northwestern. He learned the first part of the engineering business in the Rhode Island Locomotive Works.

Mr. Thomas Fieldin, who was appointed assistant master mechanic of the Missouri Pacific Railway at Cypress, Kansas, taking effect June 1, 1899, is a very thorough mechanic in every sense of the word. Learning his trade in Great Britain, his first official position after locating in this country was that of master mechanic of the Chicago & Lake Huron Railroad at Port Huron, Mich., in 1874. He was also master mechanic at Battle Creek, Mich., on the same line, and left there when the management changed, going to Texas. For some years past he has been foreman of the erecting and repair shops of the Missouri Pacific Railway, at St. Louis, Mo., from which he has been promoted to his new position. Mr. Fieldin has been a frequent contributor to the columns of LOCOMOTIVE ENGINEERING. He is the designer of numerous kinks for expediting shop work and giving better service on the road. Mr. Fielden takes the position left vacant by the resignation of Mr. W. T. New.

Death of F. M. Stevens.

The following letter will be read with sorrow by many friends of the deceased:

"You will no doubt be sorry to hear of the death of F. M. Stevens, the brother of Geo. Stevens, of the Lake Shore, whom you will remember meeting in Moscow at the time of your visit to Russia last summer. He left the Baldwin Works in 1896 to come here with me, and did yeoman's work until he left us just a year ago, upon the expiration of his contract, to re-enter the Baldwin service. He was ordered to the Far East to receive and set up the engines sent from Philadelphia for the Eastern Chinese Railway, and it is from Vladivostock that we received the telegraphic announcement of his death.

To Stevens belongs a large share of the credit attaching to the establishment of the Sormovo Locomotive Works. He was resourceful and of excellent judgment, always loyal and faithful, and as unvarying as time in the execution of his duties. In a word, he made a lieutenant any man would be proud of, and I got to know that, day or night, a call on Stevens would always find him willing and ready, no matter how disagreeable the task was.

His untimely death (he was still under fifty) has caused a genuine feeling of sorrow all through the works here, where he was known and liked. W. F. DIXON.

Sormovo, Russia.

Long Distance Runs.

The experiment of almost doubling the runs of the passenger engines of the Baltimore & Ohio Railroad has proved more successful than its warmest advocate had any idea that it would. For a great many years the average run on the Baltimore & Ohio Railroad was 125 and 150 miles, and it was supposed that on account of the heavy grades that one locomotive could not be used for a continuous run of 200 or 225 miles.

However, General Manager Underwood and General Superintendent of Motive Power Middleton determined to make the experiment, and during the past three months have demonstrated that these continuous runs are not only successful, but economical, even on the Baltimore & Ohio Railroad, where 1, 2 and 2½ per cent. grades are found.

Passenger engines are now run continuously from Cumberland to Parkersburg, a distance of 207 miles, and from Cumberland to Wheeling, 201 miles. From Cumberland to Parkersburg the engines go out on trains 1, 3 and 55, returning on trains 2, 4 and 12. From Cumberland to Benwood the run is 200 miles, and the engines go out on train 7, returning on train 46. This change has enabled the road to reduce the number of engines in that service from twenty-four to twelve, and has doubled the mileage of each engine when run from Philadelphia to Washington, Washington to Cumberland and from Cumberland to the Ohio River. Each locomotive will average very nearly 7,500 miles per month.

West of the Ohio River three engines are used to haul trains 7, 8, 46 and 47 between Benwood and Chicago Junction, a distance of 190 miles, and they will average about 7,680 miles a month. These engines are double-crewed.

Four engines at present are running trains 103, 104, 105 and 106 between Benwood and Cincinnati, a distance of 254 miles, running through west-bound and relieved at Newark east-bound. These engines are also double-crewed, and they will average a monthly mileage of 7,650 miles.

Trains 3 and 4, between Newark and Sandusky, and local passenger trains between Newark and Shawnee are run by two engines and three enginemen, the distance being 159 miles. These engines will make an average mileage of about 5,742 miles per month.

Trains 16, 17, 114 and 115, running between Columbus and Sandusky, a distance of about 149 miles, are run by one

engine, double-crewed, with a monthly mileage of about 8,012 miles.

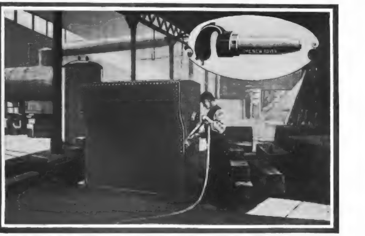
Trains 101, 102, 107, 108, 111 and 112, between Cambridge and Cincinnati, a distance of 201 miles, are handled by three engines and five enginemen, with a monthly average mileage per engine of 6,443 miles.

It is estimated that under the new method the enginemen make about the same wages with less work. They average about 3,800 miles per month each, and under the system west of the Ohio River the saving is equally as great as has been east of the river, as it now takes thirteen locomotives to handle the trains, while formerly twenty-five were required, it being a net decrease of twelve locomotives in the service, which can be very readily used in other branches of the service.

So far there has been no trouble in operating the trains, and the delays have been even less than usual.

The finest exhibit we have ever seen at a railroad convention was that of the Chicago Pneumatic Tool Company at Old Point Comfort last month. A large plant of different tools was kept at work, and there was a crowd of visitors looking on all the time. The flue cutter attracted particular attention. The exhibit was the best object-lesson of what pneumatic tools could do that we have ever seen.

We understand that the new management of the Delaware, Lackawanna & Western intend to extend the automatic station signaling system to the whole main line and branches.



BOYER PNEUMATIC HAMMER AT WORK.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(68) B. L., Detroit, Mich., says:

We have had a great many crank pins break lately. Can you give me an idea of what causes the breakage? A.—The pins were too weak for the work put upon them.

(69) W. M., Fresno, Cal., writes:

1. What is the cause of the so-called hammer blow? A.—1. It is caused by the unbalanced weights swinging round in the driving wheels. 2. Do the drivers leave the rails when the blow is delivered? A.—2. At high speeds it is found that the drivers leave the rails slightly. This happens when the unbalanced weights are moving upwards.

(70) C. N. R., Erie, Pa., writes:

1. Does the use of oxalic acid in cleaning make the brass hard? A.—1. It has that reputation, but we incline to doubt it. 2. What is the best mixture for washing off oxalic acid? A.—2. Clean water.

(71) J. W., Duluth, Minn., writes:

Will copper rivets holding brass gibs to the crosshead cut the guide unless great care is taken? A.—We have seen a few cases of this kind, but usually it does not. The rivets should be put in staggered so no two of them will rub the guide in the same line.

(72) A Subscriber, Dunkirk, N. Y., writes:

Please explain the reasons why hot air is not used as motive power in place of steam? It seems to me it ought to effect a saving of fuel, as compressed air is easily heated, at least easier than water. A.—Hot-air engines are economical, but they require much more room per unit of power than a steam engine.

(73) J. H. B., Clinton, Ia., writes:

1. Why do the driving boxes knock more when the engine is backing up than when working in fore gear? A.—1. This is very lucidly explained in a letter beginning on page 209 of our May number. 2. Is it good engineering under all circumstances to run with the reverse lever hooked back as far as possible consistent with making the running time? A.—2. No. Under certain circumstances when steam is cutting off very short there will be more loss from condensation than gain from expansion.

(74) J. W., Duluth, Minn., asks:

When a case-hardened guide gets cut can it ever be got into proper running condition unless it is taken down, ground true and case-hardened again? A.—That depends on what you would call proper running condition. If you mean by that a perfectly smooth surface again, no; but if it is not cut bad, good service can be still got out of it, without grinding and case-hardening.

(75) J. W., Duluth, Minn., asks:

Do you consider it good practice to babbitt brass crosshead gibs running on case-hardened guides? A.—Inquiry among master mechanics shows that some of them do it; a few do not. There used to be an impression that babbitt would not

do well on a case-hardened surface; but there are lots of crank pins that are case-hardened and then ground true that run O. K. in babbitted brasses. Babbitt in crosshead gibs is more liable to get grit in it than in a crank pin brass.

(76) J. W., Duluth, Minn., asks:

How would you block up for a broken forward driving brass on a mogul engine, whose forward driving springs are coupled to an equalizer leading to the engine truck springs? A.—The idea in blocking up is to take the strain off the box that has the broken brass in it. A solid block on top of the frame under the spring saddle cap will do this and leave the springs and equalizers all free to work. If the brass works out, some men drive hardwood wedges in where the brass has been in the box if it is broken and not yet out; go ahead that way.

(77) J. H., Rat Portage, Ontario, asks:

How does the reducing valve of a Pittsburgh compound work? A.—The reducing valve is located between the high-pressure and low-pressure steam chests, and reduces the steam going to the low-pressure chest, only allowing enough to pass into the low-pressure cylinder to do the same work as the high-pressure cylinder, with steam direct from boiler. The reducing valve has on its initial side a piston, one side of which is open to the atmosphere. The size of this piston is governed by the difference of the areas of the cylinders. If they are 2¼ to 1, this valve will be in balance when there is 180 pounds steam going to the high-pressure and 80 pounds are going to the low-pressure; and if there is any variation of these pressures the valve opens or closes to correct the difference, being entirely automatic.

(78) Learner, Topeka, Kan., writes:

1. Why is it that an engine with small driving wheels will start a heavier train than one with large wheels? The answer given is, because it uses the power of the cylinders oftener in a given unit of time. But he speaks of starting only. I would say if the stroke was the same with both engines it would be because there would be more power at long end of lever. Take an engine with 60-inch wheel, 30 inches would be the length of lever, 12 the short end and 18 long end. If the piston has 254 square inches and 125 pounds per square inch, we would get about 8,700 pounds at long end, or at rail. Now if wheel was 58 inches we would get about 9,700 at rail, and if you would keep her from slipping she would start a heavier train. A.—1. That is correct. 2. I would like to ask if you take two engines same size wheel, on 24-inch stroke, and one 22-inch stroke, if the power of cylinders will be used the same in a given time, and will not the long stroke start the heavier train? A.—2. It will because the longer crank used with the 24-inch stroke will give increase of leverage.

Pneumatic Tools.

The rapidly increasing use of pneumatic tools is bringing out new designs as well as causing improvements in the older ones. This can be readily seen from the new catalogue of the Chicago Pneumatic Tool Company, the two illustrations shown herewith being taken therefrom. The Boyer hammer, shown at work in one of the views, has made a great record for itself and seems to be finding new fields of usefulness almost daily. For boiler work it is particularly useful, as it can chip, caulk, bead flues and rivet up to fair sizes

When it comes to regular riveting the other cut gives some idea of the work now being handled. This shows a 1¾ x 6-inch Boyer riveter on the structural work of the North Western Elevated Railroad in Chicago. It will drive up to 1¼-inch rivets.

The catalogue abounds in fac-simile letters testifying to the tools of this company, and it will pay anyone interested to send for a catalogue.

BOYER PNEUMATIC HAMMER AT WORK ON THE NEW CHICAGO ELEVATED ROAD.

In the shops of the Burlington, Cedar Rapids & Northern at Cedar Rapids they have the wheel press so arranged that one man can take off or put on driving wheels, or take out or put in crank pins. The name of the steel maker is stamped on axles and crank pins, also the date of putting in. Close watch is kept of the mileage of axles and crank pins, and they are removed before the limit of safety is reached. The company suffer very little from broken crank pins and axles.

The Brooks Locomotive Works, Dunkirk, N. Y., have just completed what is said to be one of the most complete erecting shops in this country. It is 257 feet long and 67 feet wide, giving an area of 17,526 square feet. It is well lighted, is served by traveling cranes and has a steel roof. It was built by the Shiffler Bridge Company, of Pittsburgh.

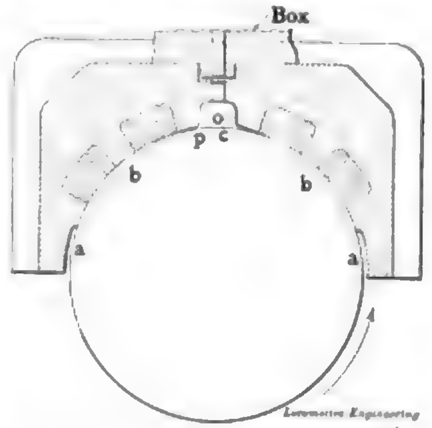
Hot Boxes.

BY H. ROLFE.

Have just been reading Mr. Conger's article on hot boxes, and I guess he can be trusted to treat the subject all right from the engineman's point of view; something further may be said about it from the machinist's standpoint.

For a box to behave itself we must have (1) everything fair and square, (2) a proper bearing between brass and journal, and (3) good provision for lubrication.

In dealing with hot boxes, whether on paper or "in the flesh," the tendency seems to be to start at what often proves to be the wrong end. I've known men have a box come in three trips running (after a general repair), and all they thought of doing was to attend to the brass itself—this including the journal, of course. Now, whenever I got a stubborn case of this kind, I used to try the box over first and see if it was all fair; for it may have been set up carelessly in the lathe (the wrong machine for the job, anyway), and hence be "a bit out." Saw this happen to a new engine once: Got a hot box on her trial trip; lifted her twice; third time, they pried her over and found the box had been chucked carelessly—so skimmed her out again in the lathe, after which she was O. K. This was when I was a youngster, but I bore it in mind with advantage. As you know, in big, modern-equipped works you dont get many jobs that are at all out of the way; there are machines and men to do every blessed thing. The men are not only kept on the one machine, but often on the one job. I knew a man who had done nothing for the last twenty years but plane up driving brasses. When you come to small "foreign" shops, however (i. e., speaking generally, anything outside of Europe or North America), where the equipment is of the scantiest and in bad shape, too, you have to do things for yourself—which is the best training, after all. Such was the opinion of the foreman I served my time under. He once set me to do up a planer, and refused me a machine for nearly everything. Had to file and scrape up the vees by hand. He said any fool could do a job if he had all the tools—the thing was to be able to do it without them. He was an A1 mechanic himself, and tried to make his lads the same; said things would be different when they were "jours" and out in the world; but he would take care they were able to do something besides run a mangle, and if ever they landed in a "backwoods" shop, they'd thank him. As I was going to remark, however, you sometimes in these shops get such a job as the following: Engine 55 comes in with a broken driving box; none in stock, but "108" is over the pit and you can take one of hers. True, her journals are ¼ inch bigger than "55's," but "that's a detail." No lathe is available, so you've got to lick it into shape by hand. Here's a good opportunity to get things a bit out, as also there is when you take a brass out of a sister engine, where the brasses are fitted in black; for although in each case the box was bored out to the horns, yet the inside of box where brass sets may not tally in both cases; so if you don't square up as you go along, you'll get one of those chronic hot 'uns we hear of occasionally. When you do get one of these inexplicable cases, it's as well to try the box over while on the journal; try a straight-edge on the inside of the flanges and measure to face of tire. This will show whether the crown is horizontal. (Sometimes the flanges are beveled off 1-16 inch, the last few inches top and bottom, to allow for rocking; you must watch for that. If the box is machined on the inside face, try the straight-edge off there, it now extending across the wheel instead of being upright.) Also try for cross twist. If the flanges are planed on edge, try the straight-edge off them in line with axle and measure off to the other journal; see that there's no rock on the box. Assuming things to be all square,



the next point to consider is the bearing. Most young hands (and some of the old 'uns, too) are very apt to overdo it in the matter of fitting up a bearing surface. They fancy that the smoother the bearing is, the better; but I don't think so—you can have such an intimate fit that the oil can't get in at all; this remark is less applicable to a big-end, but more so to a valve seat. The three requisites are, to get things square, to have a liberal and adequate bearing, and to have it properly fed with oil. Never mind about getting up the brass until you can see your face in it; the desideratum is to get sufficient bearing and in the right place.

There is another point: The practice in the first one or two shops I worked in was to bed the brass down on the crown. This, of course, necessitated considerable care, to avoid having the brass rock; and however careful one was, the legend "Boxes knocking" would not be long in making its appearance in the shed-book. Of course it was not always the journal that was knocking; it might be either that or else the brass knocking in the box or the box in the horns (pedestals). It requires pretty good judgment on the part of the runner to tell "t'other from which"; runners vary in their instinct for locating knocks. Some you can rely on; others you fight shy of, after a few cases of big ends being booked as knocking, when in reality it is the driving box; or little ends blamed when it is the slide blocks or a loose piston head; or wedges reported, when it is not them at all, but a badly fitted driving brass. Later on, I took a job in one of the repair shops and running sheds on the North Western Railroad (England), and found that there it was the practice to keep the crown of the brass off the journal when fitting on. This, of course, was only for coupled wheels—it doesn't matter so much for "carrying" wheels. The idea is that, if you let her down on the crown, and a little too hard at that, she will be riding on it like a pivot, producing the effect (in a correspondingly less degree) of a 7⅞-inch journal in an 8-inch brass; the journal will knock almost from the start. If, however, you keep her a full 1-32 inch off the crown, for a width of about 2½ inches, she will get down to her bearing in a day or two, and the right kind of bearing, too, to prevent her knocking. One should exercise judgment in fitting the brass on in this way; take into consideration the weight on axle and the strength of brass and box. I would not in any case give too much bearing; in fact, let the brass clear the journal 1-16 inch at *a a*, in the sketch. Make it ⅛ inch on the drawing; then you will have enough margin to let it go without machining. Let the brass bear at *b b*, as shown hatched, clearing at *c* a full 1-32 inch. This will lessen the complaint of journals knocking.

Of course there is one advantage in getting the sides to bear—you have more provision against knocking. This is doubtless why some people let the brass bear half-way round—not with the idea that it is of much use as a load carrier, but that it reduces the tendency to knock.

Some mechanics bore the box 1-16 inch larger than the journal, so as to insure not bearing on the sides. This practice is altogether wrong; the box should rather be bored out small. You then ease the sides off at *a a* and your brass is ready—bearing at *b b* and clearing at *c*. I prefer to do this rather than interfere with the crown; this latter is going to be our chief bearing surface in a day or two, so we want it all straight and true as it left the lathe, preserving those nice little ridges left by the tool; they are what gives the bearing a chance to "find itself." Again, you can slam into the sides with chisel and file more freely than you would the crown; it's only clearance anyway, and besides, you won't throw the brass out of square the same as you would if you made a "botch" of the crown. If the job is properly done the bearing surface need

not have been touched at all. On the North Western, however, we used to take a final scrape all around the pieces of babbitt, letting the latter stand up "the thickness of a piece of paper." This humored the bearing a little and was, of course, less objectionable than it would be in a big-end, where it would mean that much extra play after the first day or so.

We will assume, then, that the box is bored out square and is square in the pedestals, and also has a proper bearing in regard to locality. The next point is to get the right kind of bearing surface; it is very easy to make these surfaces *too* nice. Where you can leave the bearing as it came from the lathe, do so. If you have to bring her to a bearing, a scraper is pretty handy for the final touches, but don't get the surface up like a mirror, nor think you are frosting a lathe bed. Some men won't desist until they've spotted a bearing all over, like a steam joint.

The sketch, by the way, shows a driving brass used in British practice, the box being a steel casting, machined all over. This design was in use twenty-seven years ago, and is met with now, although round brasses are more common—often cast solid in the box; or to be more exact, the box (of cast iron) is run around the brass. These brasses, as also those which are machined and pressed in, close in under wear and pressure (especially when they get hot), a result not so noticeable with the flat-top brass shown in the sketch.

It has always seemed to me a bad practice to put the oil groove in the top of the brass, as here shown, as we thus rob the brass of a strip of bearing at the very point where it is most valuable. It is quite often made 1 inch wide—twice as much as it need be. Sometimes a careless workman leaves the edge *p* nearly square; this prevents the front of the brass from getting free lubrication. A spot of oil at *o*, whether it has been carried around from the pad, or has come down the oil hole, is swept back by the sharp edge *p*; this, I admit, is largely surmise, but it may account for some of the increased wear which we notice in the front brass. It is advisable to put a good fillet at *p*.

An experiment was once made which seems to argue against the oil hole being in the top. A gage was fixed in the hole and at high speed the pressure in the tube was considerable, showing that the oil tends to escape out of the hole with quite a little force.

Have also jotted down "a few remarks" on fitting up of main rod brasses, but I guess I'll hold that back for a month, or the whole lot may find its way into that cavernous waste basket of yours.

The Lehigh Valley have ordered 400 box cars of 80,000 pounds capacity; the dead weight of the cars will be 34,000 pounds.

Ancient American Sleeping Cars.

L. Xavire Eyma, a Frenchman, who came to this country in 1847, wrote an article in *L'Illustration*, of Paris, published July 22, 1848, giving his experiences on the railroads of the United States. He says that at that time the Baltimore & Ohio Railroad had a length of 70 leagues, and that the cost of the road was 4,116,744 francs; the receipts, 3,988,-456 francs, and expenses 1,964,741 francs. He also gives considerable space to the interior arrangements of the sleeping cars used at that time, and says that "They are actually houses where nothing is lacking for the necessity of life and are divided into compartments and sleeping rooms, some for men and some for women." Each room held six beds, or rather little couches, in three tiers along the sides. He winds up his account by saying that valuables were not particularly well taken care of, as in America there "were no such things as sneak thieves."

Too Much Conviviality.

In talking of his early railroad experiences, Mr. A. J. O'Hara, of Port Jervis, one of our subscription agents, said that the first job of firing he secured was on the Catawissa Railroad of Pennsylvania, now a part of the Philadelphia & Reading system. That was in the war times. The only boarding house at his end of the division was in a saloon, and the facilities for conviviality were fully taken advantage of. On the first night of his arrival a jollification was going on which made him think that some special celebration was under way, every trainman present being on a fair way to get drunk with the least possible delay. On inquiring what was the occasion for so much extra drinking, he was informed that it was the ordinary way that the boys had for enjoying themselves. Although a young man he did not feel that it was the proper way for trainmen to prepare themselves for their important duties of the morrow. He made a few runs, and found that accidents were fearfully common. He could not help connecting these with the jovial evenings, so he quit, and went looking for another job. He got one on the Erie, and has remained on that road ever since.

A road out of one of the chief cities of the Middle West some months ago began to double-head its trains. After a trial of some weeks this was discontinued, but the lesson those hind firemen got on smokeless firing "aint lost on 'em yet." Boy's the brakemen ride behind you now.

The men in charge of a shop on one of the Western roads, noted for keeping accurate account of costs, say that cast-steel driving boxes when babbitted and ready for use cost about six times as much as cast-iron.

Nickel Steel.

When the subject of "The Use of Nickel Steel in Locomotive Construction" was under discussion at the Master Mechanics' convention, Mr. E. F. J. Porter, of the Bethlehem Steel Company, was asked to make some remarks about nickel steel. In the course of his remarks he said that no concern in this country, except the company he is connected with is in a position to make nickel steel that will meet the government specifications. He mentioned several cases of failure with nickel steel which was caused by the material being unskilfully made. On account of this, nickel steel had been to some extent put into disrepute. He urged railroad men who wished to secure the benefits of good nickel steel to have specifications prepared and require those who were willing to make or sell the steel to meet the requirements of the specifications.

This was very sensible advice, and we trust that it will be carefully followed. Nickel steel is a comparatively new material for use in railroad machinery, and it is very easy for unscrupulous manufacturers to supply so-called nickel steel that, while more expensive, is really inferior to certain grades of first-class carbon steel.

Reviving a Drowning Man Under Difficulties.

The principal amusement enjoyed by visitors to Old Point Comfort is swimming or bathing in the bay. There is much horse play in the water and considerable fun is caused by the gambols of certain fleshy people who attend the railway men's conventions. There was an unprecedented incident one afternoon during the time of the Master Mechanics' convention. A young man got beyond his depth and called for help. Two gentlemen hurried to his rescue and brought him safely to the platform. The half-drowned man, who was unconscious was placed in the proper position for forcing the water out of the lungs of people in his condition. This was done by one of his rescuers, who happened to be a doctor residing in Fortress Monroe. About the time that he was getting the water out of the patient, the life saver connected with the hotel appeared with several finger lengths of whiskey in his head. This man was stimulated to believe that rescuing and restoring half-drowned persons was his own particular prerogative, and he resented the interference of the doctor. To emphasize the force of his claim he hit the doctor on the eye. The doctor continued to work on his patient until the young man was sufficiently recovered to walk away with his friends.

Then the doctor, with blood in his eye and a light bathing dress on his person, walked out to pay his respects to the life saver. That party was soon found, also attired in a bathing suit, and without preliminary explanation the doctor proceeded to rain fist blows upon the man who had assaulted him. A pretty fight was immediately in progress, and the opinion prevailed that the life saver owed his life to the interference of lovers of peace.

The Cole smoke preventing device has been applied to locomotives on several Southern railroads, and it appears to work very satisfactorily. It is a modification of what is known as the Clark smoke preventing device, one of the first smoke preventing appliances ever tried on locomotive fireboxes. The Clark jets, so-called, were operated by openings through the walls of the firebox, and by means of steam jets set in the center of a large opening induced a strong current on to the front of the fire. The Cole improvement has a water protecteu projection which goes into the fire about 14 inches and delivers the air there. That small change may be sufficient to make an old failure a success.

The new issue of "Four Track Series" No. 3, an illustrated and descriptive folder, forty-eight pages, entitled "America's Great Resorts," has just been issued by the passenger department of the New York Central. This folder gives a description of a large number of the great health and pleasure resorts reached by the New York Central, and shows the time and rates of fare to the different points, not only from New York, but from all the principal cities along the line. A copy of this folder will be sent free, post-paid, to any address upon receipt of a 1-cent stamp by George H. Daniels, general passenger agent, Grand Central Station, New York.

The locomotives of the Bound Brook route from Philadelphia to New York must tremble when they see the trolley cars marked "New York—Philadelphia," and see the little trolleys scoot past them—going the other way. It makes the business man who wants to "get there" smile to think of a trolley trip between the two cities, with the dusty roads, the hard seats and "Fare, please," every time they strike a new town. Its effect on the management of a railroad can hardly be pleasing, when it is remembered that the railway has to buy its right of way and carry it as a fixed charge, while the trolley grabs the highway with usually no compensation. Still, we are not ready to quit just yet.

The Street Railway Journal has issued a weekly news edition to its subscribers, sending it without additional cost. It gives the street railway news of the country that is likely to interest its readers, and we feel sure it will be appreciated by them.

An Aluminum Hand-Car.

An aluminum railroad hand-car is being built by the St. Louis Aluminum Casting Company, and the makers propose its adoption by railroad companies to take the place of the ordinary muscle-taxing contrivance used by track workers. The new car will be constructed largely of an aluminum alloy of great strength and lightness—that is, the wheels, body and walking beam will be made of this metal. The axles will be of steel tubing. Other improvements will consist of gearing of the bicycle pattern, admitting of adjustments for speed, of ball-bearings and of a hub brake, whereby brake power may be applied by simply pressing a button. The new car will weigh not more than 150 pounds, or only about a third as much as the ordinary hand-car, and one man can lift it off or on the track. It is believed that two men can easily run it from thirty to thirty-five miles an hour for a limited time.—*Franklin Institute Journal.*

Detroit Graphite Paint Company have almost completed the construction of their new factory on the corner of Twelfth and River streets, Detroit, Mich. The building is of brick and stone, six stories high, 53 x 74 feet, and is erected in accordance with the best rules of modern mill practice. It is so arranged that, in the course of manufacture, the product will pass through its processes from floor to floor, until it reaches the first floor in finished condition, ready for shipment or for storage in the basement. The grinding and mixing machinery will be driven entirely by motors, the Westinghouse Electric & Manufacturing Company installing a complete power and lighting plant. With these new facilities the Detroit Graphite Paint Company hope to catch up with the demand for its products.

A visitor to the shops of the Chicago, Burlington & Quincy at West Burlington can see in use a practice of painting by dipping. They will not see cars dipped in a vat filled with paint, which would be quite feasible, but they will find that cattle guards and a great many other articles receive their coats of paint in this way. The cattle guards for this road are all painted white. This is done because one of the engineering staff discovered that cattle or other four-footed animals will not attempt to cross a cattle guard that is painted white. It is strange, but true.

"I don't mind being laid out with a hot box once in a while on one of the fast trains," said a traveling man, "but when it comes to a local, I kick. They don't run over fifty miles anyhow, never make very high speed, even between stations, and there is no excuse for it. If the cars were looked after as they should be there's no excuse for a hot box on a fifty-mile run."

The Tubular Despatch Company owning and operating the pneumatic mail-transmission tubes in New York city, have placed an order for three duplex Corliss air compressors with the Pneumatic Supply & Equipment Company of New York, recently organized to install complete compressed-air plants. These three compressors are to be located in the sub-basement of the Metropolitan Life Insurance Building, New York city. The capacity of each compressor is in excess of 1,300 cubic feet of free air per minute, and the entire cost of the installation is understood to be over $12,000.

We have received a letter from Prof. Carpenter, of Sibley College, Cornell University, saying that he is represented in an advertising circular as certifying to the excellence of a fuel-saving compound called "Kalor," manufactured by the National Fuel Compound Company, of Boston, Mass. The circular states that he has made a number of tests and found great saving due to the use of this compound. He protests that he never made any tests of this compound, and knows nothing about it. It appears that the parties who issued the circular are misrepresenting facts. Any of our readers who are approached to use this material, "Kalor," had better remember that its agents are pushing it by misrepresentations.

A very handsome illustrated catalogue has been issued by the Standard Steel Works, of Philadelphia, which gives several fine views of the works and of the work turned out by them. There are also several etchings, showing tires made by the company. Besides the pictures there are a variety of specifications for steel tires for American and foreign railroads. Master mechanics and others interested in the purchase of tires will find this catalogue a useful reference.

The American Pneumatic Tool Company, of New York, have sold to the National Pneumatic Tool Company, of Philadelphia, Pa., the right to manufacture pneumatic tools for use in the metal trades. This privilege is to be exclusive, except as regards the American Pneumatic Tool Company, which will continue to make and sell pneumatic tools for all purposes as heretofore.

The Franklin Institute has ordered John Scott legacy premium and medal to F. N. Connet and W. W. Jackson for the invention of the registering apparatus of the Venturi Meter. This is in addition to the Elliott-Cresson gold medal awarded some time ago to Mr. Clemens Herschel for the invention of the Venturi meter tube. These are made by the Builders' Iron Foundry, of Providence, R. I.

Air Brake on the Bicycle.

When people learn that a device which is excellent in one case may be worthless in others, there will be less money wasted, and Uncle Sam's income from foolish patents will take a sudden drop.

The latest misapplication of a good thing is the air brake for bicycles, recently patented by an enterprising hoosier. A little oscillating pump is fastened to the rear forks or stays, a triangular reservoir is tucked up in the frame below the saddle, and the pump is driven by a pulley engaging the chain.

Instead of being on the Westinghouse principle, it acts by throwing work on the wheel in the shape of compressed air. To brake, you close the right valves, and the pump starts to work, checking the wheel easily and gently.

We fear, however, it will never be popular, even if it is an air brake, for the extra parts and the constant work to keep the pump going are all against it. This is a case where the plain hand brake has all the advantage.

Mr. John Hickey has replied in a letter addressed to General Superintendent Welby to the criticisms made on a previous letter, in which he wrote strongly against the Master Car Builders' type of car coupler. He says that if the link-and-pin attachments had received one-eighth of the thought or one-twentieth of the expense given the Master Car Builders', the accusation that the link-and-pin couplers were more expensive to maintain could not be successfully maintained, and it cannot be maintained if due comparisons are made with the improved and automatic link-and-pin type.

It is wonderful the important results that often flow from what may be regarded as trifling things. A good illustration of this came home to the railroad world lately. A telegraph operator received an order to stop the first section of a passenger train for orders. The train ran past and had to back up; but even with this delay the operator did not have the orders ready for delivery. There was delay of one minute after the conductor reached the office. That seemed trifling, but it gave time for the second section to overtake the train standing at the station and kill twenty-nine human beings. Of course no responsibility was placed upon that operator, but he did more to cause the accident than any man connected with the movement of the trains. He was evidently the no-account sort of man who is kept in a responsible position because his services are cheap. It is, however, a painful case of cheap help proving dear in the end.

Some time ago we wished to obtain a few railway scenes in Japan, and we applied to Takata & Co., 10 Wall street, New York, asking if they would kindly favor us with some photographs. They did not have anything at the time, but we have recently received through their courtesy a book of 10½ x 14 inches, giving fifty-eight full pages of half-tone illustrations. The artistic work and the printing are beautifully done and the book constitutes a most interesting pictorial account of Japanese railways and railway machinery, besides giving a great many other illustrations of romantic scenes with railroad connections. Considerable number of the scenes are in color, very ably done. We judge from the illustrations that there have been a great many physical difficulties surmounted by the engineers who surveyed Japanese railways.

The Armstrong Manufacturing Company, of Bridgeport, Conn., has found that its business increases so rapidly that another addition to the facilities has been found necessary. This is the second increase since January 1st. Much new machinery is now being added to the works, and the company has built a large fireproof warehouse, to which the shipping department has been transferred. All orders for the company's goods can now be filled promptly. An increase of 30 per cent. of the export business within the past few months is reported. No less than $125,000 worth of pipe-threading machines has been exported to Germany since January 1st. This amount is greater than the entire production of Germany, whose markets are practically controlled by the Armstrong Manufacturing Company.

The Safety Car Heating Company, 160 Broadway, New York, have issued a new illustrated catalogue, showing their car apparatus and fittings. The pamphlet contains 153 pages, 8½ x 11 inches, and most of the pages are almost full of very good clear engravings, illustrating the apparatus and details of the system used by the company. It will be a very good book of reference for those who have to order parts for the repair of steam heating, and also to those who have to fit up locomotives or cars with this equipment. Every part is numbered and shown in a manner that will enable anyone with a screwdriver to put the parts together. We believe that it is the intention of the company to have this catalogue in the hands of the men who have much to do with fitting up and keeping this steam heating system in working order.

It is estimated by those who have made industrial statistics a study that the production of steel in the United States during 1898 was more than equal to the whole of the steel made in the world from the time Tubal Cain started up his forge to the nineteenth century.

A Sand Box Kink.

On the Union Pacific Railroad they are putting a small box or platform open at two sides over each sand valve to hold the weight of the sand in the box off the valves, so they can be opened and shut with ease by the engineer from the cab.

This box or platform is 6 inches long by 4 inches wide and 1 inch high. It has a 1-inch hole in the top, just over the opening into the sand pipe, so sand flows down through it when the valve is opened. It is fastened to the sand-box floor by small tap bolts. The shaft which connects the sand lever to the valve passes up through the top of the platform. One of the small rods we usually find through this shaft to keep the sand stirred up loose, passes back and forth over the hole in the platform and keeps it free from stones, etc., that may get into the box and clog the hole; in some cases a small paddle is put in to stir up the sand well.

We have received a great many complaints of late from subscribers in Australasia to the effect that their papers are received in bad condition, the wrappers being frequently torn and off and the covers damaged. We have tried to locate the cause of this trouble, but in vain. The papers are shipped from the New York post office in good shape and we believe that they reach San Francisco in similar condition. As far as we can make out the damage is done by rough handling of the bags between San Francisco and the point of delivery. If any of our friends can give us information that would locate the exact source of trouble we will be under obligations.

Under the able editorial management of Mr. G. A. Warburton, *Railroad Men*, which is published by the Railroad Branch of the Young Men's Christian Association, at 361 Madison avenue, New York, has forged ahead until it is by all means the best publication of the kind on this continent. Mr. Warburton has been fortunate enough to induce some prominent railroad man to write an article for nearly every issue, and the character of the other reading matter is kept up to a high standard. The magazine costs only 50 cents a year.

We have referred several times to a scheme that was going on to form a trust to control the manufacture and sale of railroad supplies. After much labor it took the form of the American Railway Equipment Company, and its purpose was very ambitious indeed. The friends of the scheme say that it was almost consummated when the death of a well-known capitalist suddenly brought all the hopes of the promoters to wreck and ruin, and now the American Railway Equipment Company has gone the way of the bearing-metal combination.

The Standard Pneumatic Tool Company, Marquette Building, Chicago, Ill., have just issued Catalogue "D." This shows and describes their line of air drills, boring machines, hammers, blow-off cocks, flue cutters, flue rolling machines, riveter, staybolt cutters, chain hoists, pneumatic jacks and many other appliances. Their tools are simple in design and are well made. Some of the applications of these tools are shown from photographs. Their New York office is conveniently located at 141 Broadway.

The Mason Regulator Company, of Boston, Mass., have favored us with their latest catalogue, dated June 1, 1899. It is small, handy for the pocket and shows their line of steam regulating devices and steam pumps in a very compact form. The working parts of many of them are shown, which give one a good idea of their construction. The well-known air-brake pump regulator remains on the list, and those who have used them say they are hard to beat. If you want to keep posted on regulators send for a copy of this.

"Salt Lake City" is the title of a neat little booklet issued by the Rio Grande Western. It shows charming little views of "the city of the saints," and will, we feel sure, induce many to take a trip to that city. The text is well written, and those interested will do well to communicate with L. A. Wadleigh, general passenger agent of above road at Salt Lake City.

D. Saunders' Sons, of Yonkers, N. Y., have just issued two comprehensive catalogues of their pipe threading and cutting machinery and tools. One shows their machinery, both for hand and power, while the other is devoted to the tools used, such as dies, taps, chucks and reamers. They are fully illustrated and give what may safely be called modern methods of cutting and threading pipe.

When there is decided conflict of opinion in a mechanical association about the value of any engineering device, it may safely be concluded that the device has not been properly developed, or that the people using it have not been educated to give the appliance the intelligent care and attention that it ought to receive. An exception to this rule seems to be found in the use of tail rods for carrying part of the weight of heavy pistons. The question of "What advantages are gained by the use of piston rods extended through the front cylinder head?" was discussed at the last Master Mechanics' convention.

Advice to Firemen.

At a recent examination of firemen for promotion held by a railroad company in New York we learn that out of thirty-two examined only seven passed, about 22 per cent. This is a very poor showing, especially so when we remember the many opportunities and facilities there are at the present time for learning and gaining knowledge at a mere trifling expense. Probably those who failed to pass are those who have no ambition to succeed, who are simply contented to live and die firemen. If such is the case it might be as well for those men to remember that railroad companies of the nineteenth century do not want that kind of material. This is strictly a progressive age. It is impossible to stand still. We must either go ahead or fall by the wayside. There is absolutely no reason for failure if the men will only take interest in their work and appreciate the fact that they in their position are just as important in the successful running of an engine as the engineer. It will be, not only the means of making them better men, but will create the desire to improve, which ultimately means success.

LOCOMOTIVE ENGINEERING has been the means of helping to educate and advise thousands of railroad men, and it stands to-day just as willing to advise and help those in need of information as it has in the past.

A meeting of railroad men was held in San Francisco last month for the purpose of organizing a railroad club. It was called The Pacific Coast Railway Club. A W. Foster was elected president; H. J. Small, first vice-president; Frank Graham, second vice-president; W. S. Palmer, third vice-president; W. F. Russell, fourth vice-president; E. A. Gilbert, secretary and treasurer, and H. A. Hummell, assistant secretary. John Bonner, W. S. Palmer, D. P. Kellogg, H. H. Hale and M. Zook were appointed a Committee on Subjects.

In the report on the relative merits of cast-iron and steel-tired wheels for locomotive and passenger car equipment the inclination of the committee was to favor the use of cast-iron wheels for cheapness' sake. One exception was made. Steel tired wheels having been recommended for engine truck wheels, Mr. F. Slater, a bright young man, member from the Chicago & Northwestern, threw a most embarrassing question at the committee by asking if the recommending of steel-tired wheels for engine trucks did not display want of entire confidence in the cast-iron wheel as a whole.

After traveling in the Central and Western States it seems queer to go down in New England and find the cars on the best trains without the Gould or Standard platforms. They are coupled fairly close, of course, and there may not be much danger, but the absence of the continuous platform and the vestibule is very noticeable. The latter is particularly needed if one wishes to keep fairly clean in hot weather.

At the West Burlington shops of the Chicago, Burlington & Quincy they use an old pile driver for breaking scrap, which is run to great advantage. It is operated by a horizontal air cylinder that pulls up the weights. It can be operated much more rapidly than the ordinary pile driver. Those in charge there say that the draw-bars break much more easily in cold than in warm weather—an old tradition, probably true.

After seeing the growing tendency for plain engines—black with black stripes, as a friend of ours calls them—it is rather startling to see those for the Chinese Eastern Railroad. A recent visit to the Baldwin erecting shop showed the wheels, cylinders and saddles painted in peacock blue with light yellow stripes.

One of the most handsome souvenirs that gladden the hearts of people who are friends of railway supply men was recently received by us from the Safety Car Heating & Lighting Company, New York. It consists of a silver heart formed as a key-holder and a silver chain attached and ring to connect with button. We have been giving away key-holders ourselves as souvenirs, but this one knocks ours out so thoroughly that we sadly removed our keys from our nickel ring and slipped them into its more brilliant rival.

The Ferracute Machine Company, of Bridgeton, N. J., manufacture a full line of sheet-metal machinery, and have recently issued a very neat and complete catalogue, No. 12, illustrating and describing over 300 sizes and styles of presses, which will be found of interest to manufacturers of sheet-metal goods. The catalogue will be a very useful reference to foremen and others in charge of metal-cutting operations. They will receive it free on application.

A handsome design, when appropriate, enhances the value of an advertisement. To attract attention is the first requisite of an ad. How this may be done is shown in a booklet just issued for free distribution by the Trade Paper Advertising Agency, 150 Nassau street, New York City, which has secured the services of Harold McGill Davis, the experienced ad. writer and designer. The booklet is well gotten up, and the designs shown are very effective.

CONTENTS.

INDEX TO ADVERTISEMENTS.

ABOUT L. W. POND

PLANERS,

WORCESTER, MASS.

Railroad shops need a planer that is rigid, heavy enough not to spring under any cut, yet not clumsy to handle. It must work fast and keep at it. Broken or disabled planers don't earn any money. If you want one that meets all requirements SPECIFY the L. W. POND kind.

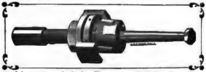
Shall we send circular describing it?

BOUND VOLUMES

For 1898.

There are still a few more left. Wont last very long though. $3.00 brings one postpaid. This Office.

MONEY To PATENT Good Ideas may be secured by our aid. Address, THE PATENT RECORD, Baltimore, Md.



In Close Places

where you can't swing a hammer to drive a mandrel the Furgerson Self-Feeding Expander does the work. Does it well too—beats hammering for any work. Made right and left-hand. If you use Jacks or Punches better get our circulars.

A. L. HENDERER'S SONS, 77 to 87 MARYLAND AVENUE, WILMINGTON, DEL., U. S. A.

Locomotive Works and Car Builders NEED

The Armstrong

Pipe Threading and Cutting-Off Machines,

Adjustable Stocks and Dies, and other tools.

NEW NO. 0 MACHINE.

A Catalogue if you ask for it.

Manufactured by

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The Audit Company examines and reports upon the accounts and financial condition of corporations, copartnerships, and individuals, and examines and reports upon the physical condition of railroad, manufacturing, and other properties.

Its services are of value to investors, financial institutions, borrowers of money, directors of corporations, merchants, firms, and purchasers of properties.

FIGURE IT OUT...

Don't ask the boss what gears to use every time you want to cut a different thread, or ask him to guess at the weight of a shaft. You can figure it out yourself with very little trouble, then you'll know how and not be dependent on anybody. A copy of

Machine Shop Arithmetic,

By COLVIN AND CHENEY,

50 Cents,

will show you how to figure any shop problem that comes up. It's a plain little book, written by shopmen for shopmen.

Locomotive Engineering,
95 Liberty Street, New York.

...Send... ..For New.. ...Catalog...

This Die Head

handles everything from ¼ to ¾ inch inclusive. Easily and quickly adjusted. Opens after thread is cut. No stopping or reversing of machine.

Our PIPE CUTTING and THREADING MACHINES

HAVE NO EQUALS.

We have a new nipple chuck that is the best on the market.

D. SAUNDERS' SONS,

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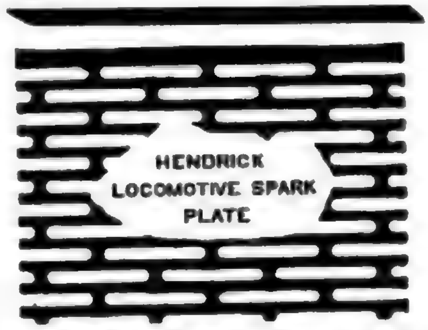
Mark your Tools with a Steel Stamp.

Send for Price-list No. 8.

Spark Arrester Plate.



THE HENDRICK MFG. CO., Carbondale, Pa.

THE CLOUD STEEL TRUCK FRAME

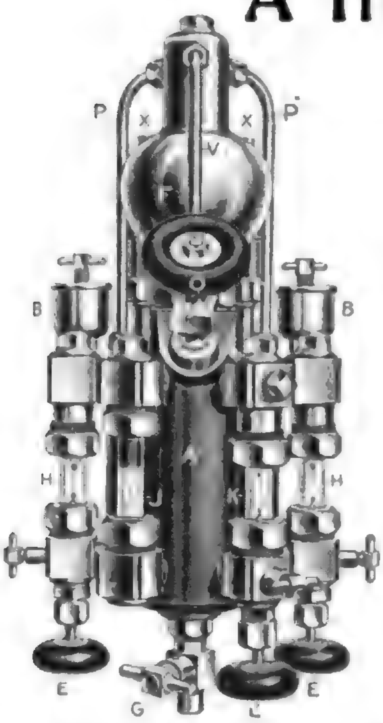
For Freight Cars and Locomotive Tenders.

Using either Coil or Elliptic Springs.

THE CLOUD STEEL TRUCK COMPANY,

1425 Old Colony Building, Chicago.

A Trial Convinces...



"Our Motive Power Department have been making some experiments, and find your Lubricator, with what is known as the Tippett Attachment, to work very satisfactorily."

So writes a prominent official of one of the great trunk lines, some of whose engines have to make very fast runs and perform other exacting service. The Detroit Lubricators, with Tippett Attachment, keep the vital parts perfectly oiled, no matter how great the back pressure, so that engines equipped with them always make a much better showing than when other lubricators are used.

Blueprint of our new No. 3 Triple Lubricator, with Tippett Attachment, and descriptive matter sent on application.

Detroit Lubricator Co.,

Detroit, Mich.

...CHARTS...

There are a few more left, but we can't tell how long they'll last. When they are gone no more will be printed — plates went up in smoke in our fire last December.

Prices remain:

Locomotive Chart "999,"	25c
Passenger Car Chart, .	25c
Air Brake Chart, . . .	25c
SET for	50c

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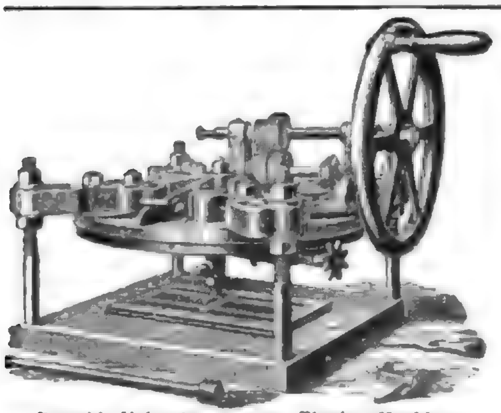
Locomotive Engineering,

95 Liberty Street, New York.



Portable Valve Seat Rotary Planing Machine.

RAILWAY REPAIR SHOP TOOLS.

Radius Planer Attachments.
Improved Portable Locomotive Cylinder Boring Bars and Fixtures.
Portable Valve Seat Rotary Planing Machines.
Portable Facing Arms.
Boring Bars for Lathe Works.

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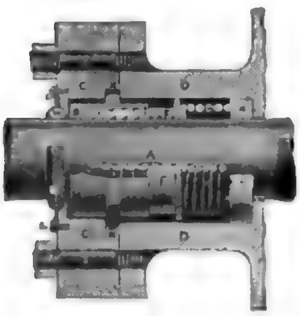

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AND ENGINEERS ALL CONSIDER

The Jerome Metallic Packing

THE BEST ON THE MARKET.

It is now in General Service on more Locomotives than any other Packing in the World.

The Packing Ring can be closed around the Rod without disconnecting the Piston Rod from Crosshead.

C. C. JEROME,
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CHICAGO, ILL.

EASTERN REPRESENTATIVES:
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Full of railway pictures and information.
6 cents a copy, postage paid.

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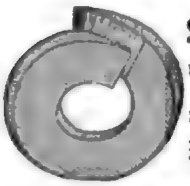

GOULD'S
Steam & Water Packing
Patented June 1, 1880.
Especially adapted for Locomotives.
Never sticks the Throttle.
The Original Ring Packing.
In ordering give EXACT diameter of Stuffing Box and Valve Stem.
None genuine without this Trade Mark
THE GOULD PACKING CO.,
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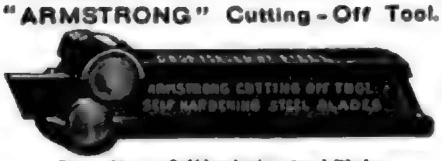
"ARMSTRONG" Cutting-Off Tool.



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MANUFACTURED ONLY BY
Armstrong Bros. Tool Co., Chicago, Ill., U.S.A.

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BOILER,
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Tank and Sheet
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Quality Unsurpassed.

Plates up to 118 inches in width.

FIRE
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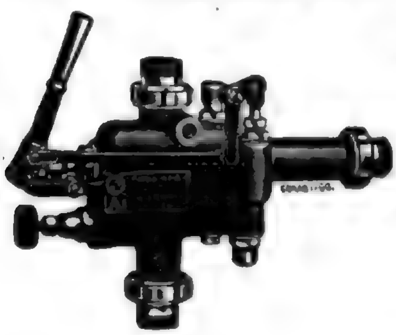
THE HANCOCK INSPIRATOR.

Absolutely no Adjustment..



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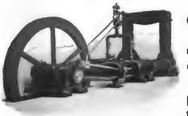

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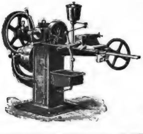

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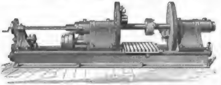

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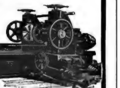

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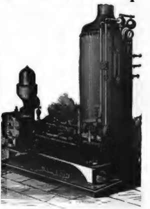

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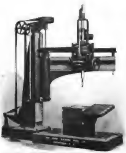

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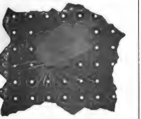

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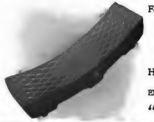

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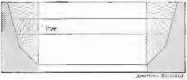

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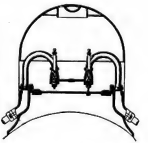

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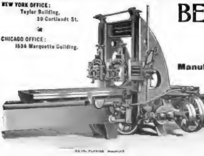

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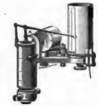

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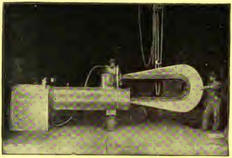

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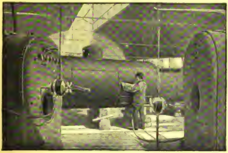

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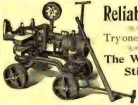

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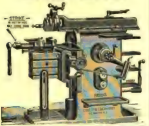


STROKE

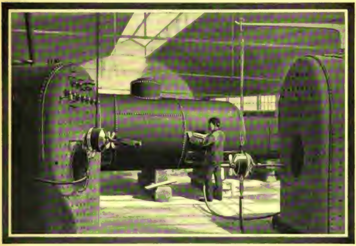
Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

August, 1899

95 Liberty Street, New York

Price 20 Cents



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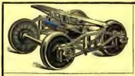

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// Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XII 95 Liberty Street, New York, August, 1899 No. 8

The Saratoga Limited.

This new and handsome train, inaugurated by the New York Central, and running over that and the Delaware & Hudson Railroads during the summer season, made its initial trip on Saturday, June 24, 1899.

It is composed of cars built exclusively for this service by the Wagner Palace Car Company, at their works in Buffalo N. Y. There is a combination buffet, smoking and library car, which provides all the comforts and conveniences of a first-class club; two large parlor cars, which are unusually roomy and attractive, and a combined parlor and observation car, from the large plate-glass windows of which the beautiful panorama of the majestic Hudson River may be enjoyed to its fullest extent. The interior arrangements are luxurious and complete, and the artistic effects are in good taste and exceedingly rich and harmonious. The exterior appearance is handsome and imposing.

F. W. Blauvelt, N. Y.

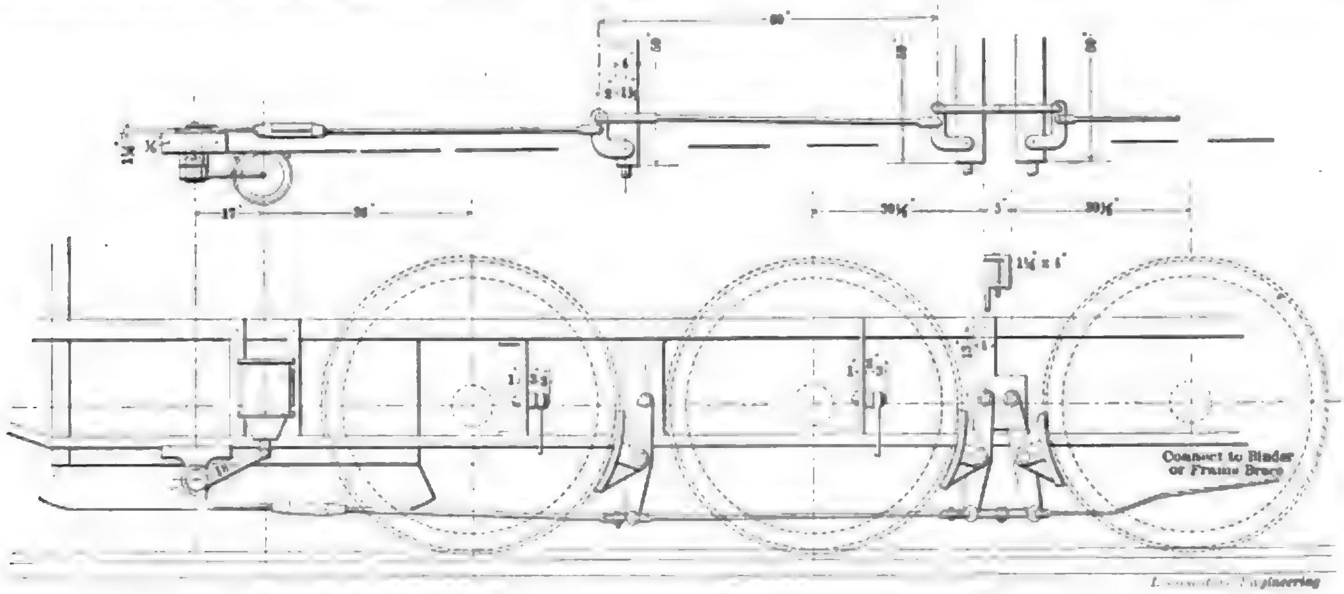
THE NEW YORK CENTRAL'S NEW FLYER.

The "Saratoga Limited" Passing High Bridge at Full Speed .

The schedule time is very fast, being equal to that of the famous Empire State Express; the run from Grand Central Station, New York City to Saratoga, a distance of 185 miles, being made in 225

minutes, including several slow-downs and one station stop, Albany; where a change of engines is made.

The engraving herewith illustrates the train, drawn by one of the New York Central standard express engines, No. 907, as it was passing the station at High Bridge, New York City, at full speed. The picture was taken without any previous arrangement having been made with the enginemen; hence there is no beautiful column of black smoke arising from the smokestack, which, the writer thinks, adds much and gives life to such pictures, as well as indicating that the train was in motion; but there can be no doubt about that when one notes the cloud of dust which can readily be seen flying underneath the cars. In fact, the speed was so much faster than the writer had expected



DRIVER BRAKES.

it to be at this point, that he was doubtful about having obtained a successful negative until the plate was developed.

While the "Limited" is distinctively a summer train, nevertheless, it is one of America's typical fast express trains, which has at once become very popular with the traveling public, and is, therefore, worthy of more than passing notice.

F. W. Blauvelt.

New York.

Driver Brake Arrangement.

The Chicago & West Indiana Belt Line have an arrangement of driver-brake levers on their six-wheel switch engines that places the brake shoe back of the forward driver instead of the ordinary method of placing it ahead. The illustration above makes it clear. This arrangement locates both pins for top end of first and second brake-head hangers on the same plate or fastening to the frame. The fastening on the frame next to the cylinder gives more trouble from working loose than both the other ones. This method does away with most of the trouble. It also leaves a clear place for front sand pipe; but the point the engineers look at is that when the engine is derailed, there is a good place to locate a replacing frog to get the engine on again.

The good points which Master Mechanic Peck claims for this arrangement of driver brakes are:

1. Engine rides better when the brake is set than before.
2. The weight is reduced on the front wheel, as the brake presses up when set instead of pulling down.
3. Saving of springs and hangers on the front wheel.
4. In pulling the brake off, cannot break frame bolts, which are expensive to renew.
5. Can get the sand pipe much nearer the wheel than before.
6. Shoe is not in way of frogging engine on track when derailed.

The New Line to Providence.

The Narragansett Bay Line, or the Bay Line for short, is a new comer in the passenger field, and bids fair to become a very popular route. It is an all-water route to Providence, and stopping, as it does at New Haven, it gives residents of that city and surrounding places an opportunity not hitherto enjoyed.

The two boats now running are the "Richard Peck," the well-known flyer of the Sound, and the "C. H. Northam," but on September 1st the twin-screw steel steamer "Chester W. Chapin" is expected to be placed in commission. This will make a pair of the fastest steamers in these waters.

Leaving Pier 25, East River, New York, at 4 P. M. you swing under Brooklyn Bridge and down through East River to the Sound. This enables you to see all the interesting sights, Blackwell's Island—where you thank your lucky stars you are not confined, though for a prison it's a pretty fair place after all—and all the other points, including Hell Gate, and you are in the Sound at last. You reach New Haven at 9 P. M., and if you feel disposed you can wander around the town, or ride around on the trolley. If it's hot you will probably prefer to stay on the boat and enjoy the music.

The boat leaves here at 10:30, allowing those who cannot leave New York at 4 o'clock to catch the boat here by taking the 8 o'clock train on the New Haven road. This will be appreciated by many who enjoy the night on the Sound, and yet cannot leave until late.

Meals are served at convenient hours, so that no thought need be taken on that score, and the prices seem to be reasonable for the service rendered, which is of the best.

Connection is made with trains for all points north and east, and every convenience in the way of baggage transfers seems to be afforded. Bicycles are checked and carried free—a point on which many of us are a little weak—and this is apt to increase the leaning toward this line.

Providence is reached at 5:30 A. M., in time to catch the early trains for Boston, Worcester or other points north.

Returning boats leave Providence at 4:30 P. M., and give a daylight view of Narragansett Bay and Providence River, which makes a beautiful sail that is thoroughly enjoyable. Last, but not least, the rates are somewhat lower than the other lines, a point that is always worth considering.

The Ball Bearing Company, Boston, Mass., of which W. S. Rogers, of *Air Brake Primer* fame, is now manager, have favored us with an 1899 catalogue. It shows their various ball and roller bearings, which are being largely used by progressive tool builders and shop men.

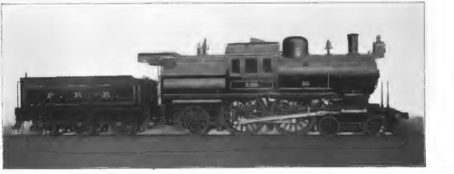
Favors Smoking in Christian Association Rooms.

One of the most sensible and level-headed men of our acquaintance is Mr. J. Q. Van Winkle, general superintendent of the Big Four at Indianapolis. Mr. Van Winkle has displayed the good sense to assail a goody-goody rule of the Young Men's Christian Association, which forbids the sale of cigars or tobacco in the association rooms or the use of tobacco while in the rooms. We know that these illiberal and narrow-minded rules have kept many railroad men from joining the railroad branches of that association, and we are glad to learn that an influential railroad official has spoken on the side of liberality and common sense.

A local paper quotes Mr. Van Winkle as saying: "The railroad companies fit up comfortable and inviting quarters at division points for trainmen and other employés to spend their time in when off duty; they have reading rooms, bathrooms, a good restaurant and good beds. The intention is to have the men feel that it is a home for them, and in this manner it is hoped to keep them from visiting saloons, gambling houses and other resorts and forming bad habits, the intention being to elevate them morally and religiously. That is all right, and the Big Four and myself contribute liberally to the support of these institutions; but a mistake is made. Under the rules of the Young Men's Christian Association we are not allowed to sell tobacco or cigars, or give them away to be used about the building. Ninety-five out of one hundred of the railroad men use tobacco in some form, and, like myself, would rather go without a meal than miss the enjoyment of a good cigar. This craving for tobacco forces the railroad man to go across the street to a saloon to get his tobacco. I have decided to try the experiment at Brightwood and East Saint Louis, of allowing tobacco and cigars to be sold to the men, so that they may not be obliged to visit a saloon to get a cigar or tobacco."

The New Pennsylvania Locomotives.

The Pennsylvania Railroad have made quite a departure from their standard practice in the three engines recently turned out for the run between Philadelphia and Atlantic City. As will be seen, they are of the "Atlantic" type and similar in general appearance to the Atlantic City Railway's engine which was illustrated last year. They have several rather peculiar features, one of them being the dome and sand-box in one casing, making it look like an extra large dome. The tank is of the six-wheel type, with the last two pair of wheels equalized. They are well-designed engines, and have a business-like air about them that is pleasing to see. They are known as Class E-1.



PENNSYLVANIA'S CLASS E I.

The cylinders are 20½ by 26 inches, drivers 80 inches, trailing wheels 56 inches, boiler of Belpaire type, 67 inches in diameter, with 42-inch combustion chamber. Heating surface is large, being 2,320.4 square feet total, with 218 feet of this in the firebox. Some of the other dimensions follow:

Driving axles—9¼ and 8½ by 13 inches.
Truck axles—5½ by 10 inches.
Spread of cylinders—85½ inches.
Ports—1½ and 3 by 20 inches.
Valve travel—7 inches.
Flues—353, 1¾-inch.
Firebox—104 by 96 inches.
Grate—69.23 square feet.
Weight on drivers—101,550 pounds.
Weight, total—173,450 pounds.

While these engines are not yet down to business in the record-breaking sense, they have done some good running on the New York division with heavy trains. Very fast time is reported on several occasions, but, as we have no official record of this, it is better not to make any statement as yet. When they get down to work in regular service we shall expect some interesting reports.

Plain Talks to the Boys.

BY C. B. CONGER.

Why cannot we hear something about the big mileage we have to make on oil nowadays at this meeting? you say.

Well, that is a pretty tender question to discuss, for the views of different men vary so widely that they are sure to clash whenever the question comes up. On the one hand, some of the motive power officers look at a good oil record as only the beginning of the possible saving that can be made in this direction. When they get down to business it is carried to an extreme point.

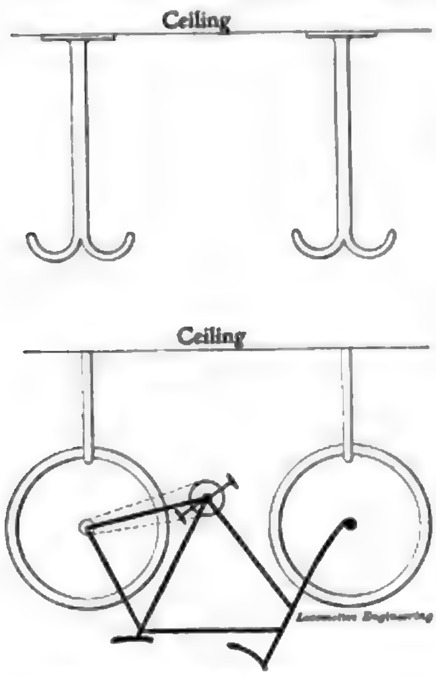
On the other hand, some of the engineers and repair men who use the oil argue that for all the oil costs it is just as well to use plenty of it and not bother with learning how to use just enough to do the work and no more. When these two views meet on the same railroad it means trouble for all hands, and at the same time the bad feeling between the employés and the officers interferes with economy of operating expenses in other directions. This last point is not given the attention it deserves. It is worth while to bend a little sometimes to preserve the cordial relations with all hands that is so necessary to smooth and economical railroad operating.

There is a middle ground between the two extremes on which all can meet. Most of us are there already on this question. As my education and training for a good many years have been in the line of operating a locomotive, do not blame me if I appear to lean a little over to the side of having a fair supply of oil and being held responsible for a good use of it.

A good deal of the opposition to the restrictions on the use of oil comes from the fact that it is a great deal more trouble to be saving of oil than to be liberal in its use, and when some plan is started that affects the ease with which certain work is done, we are apt to condemn it at the start, and after a time fall in line with all the others and make an economical record.

Journals and bearings do not need a surplus of oil half as badly as they need good care and careful inspection. Now it is plain that if less oil is used more care and a closer inspection will be necessary at once. That is one of the objects accomplished by limiting the amount of oil to be used, so that more care will be used to get it in exactly the right place and at the right time. You that have had at one time all the oil you thought necessary and then been put on what looked like starvation rations will concede this point.

There is no doubt that the question of saving oil has been brought to the notice of the managing officers by the great difference between the large amount of oil used by the man who paid no attention or care to its economical use, and the small amount used by the careful one. When it shows up on the oil requisitions that one man draws two gallons of engine oil and the same amount of valve oil for a trip of less than 150 miles—I have seen this done for years; it is not a fancy estimate—and in addition reports engine truck cellars and tender trucks packed about once a week, while another engineer in the same service will make four or five trips with that amount of engine oil and go fifteen times as far with the valve oil, the men in charge of operating expenses are apt to ask, Why is there such a difference? Then when they look over the report books and delay sheets and see that the man using the most oil has just as many hot boxes and delays on the road as the close man on oil they ask some more hard questions.



BICYCLE RACK IN BAGGAGE ROOM.

Then, again, on a road where very little attention has been paid to the matter of oil economy, they find out by comparisons with their neighbors making a better mileage on oil, that they actually have less trouble with hot boxes and delays; and of course they begin to inquire into that matter, too. Do not think these points will not all come out; the interchange of ideas and methods of operating are surely bringing to view all these matters.

If there was only a small difference in the cost for oil and bearings in the instances compared, it would be passed by without much comment, but a great difference is paid attention to at once.

You should not blame the economical engineer or the economical road for all the trouble the oil question has caused in the last six or eight years; it is the waste of oil that has called attention to it.

The worst feature of the matter is that when the increase of engine mileage per pint of oil begins, it does not always stop within reasonable limits. The small engines on light runs are taken for the standard to which the heavy engines on fast runs must conform. It is obviously unfair to expect that a heavy engine with large cylinders and high steam pressure will run on as small a supply as a light engine. It is nothing unusual to find a through freight engine running at night with few stops, compared with one just exactly like it drawing a local freight train all day long, with a mileage much less and a schedule twice as long, and no allowance made for detentions, switching and way work. As a consequence, the through-freight man can hold up his average easily, while the local man is on the ragged edge between hot boxes and discipline for a poor record. That matter causes more hard feelings than any other phase of the oil question, for a man does not like to be compared with his fellow craftsman who has an easier time.

There is one redeeming feature in this matter that has been a genuine help to the engine men. In order to make a good oil record, it has been necessary to put all the journals and bearings up in good shape; see that the oil cups are kept in proper condition, so they will feed just enough and not too much; look out for leaky and defective sight-feed cups; attend to all the joints, so that oil will not leak out, and in all ways possible make the supply of oil issued go as far as possible. Do the companies do this? you ask. No, they do not in all cases; but if they do not, it is partly the fault of the employés. It is a very easy matter to show up leaks when you take hold the right way.

But there is one view of this oil question that is seldom touched upon. Every operation connected with handling a locomotive and train requires a mental effort on the part of the engineer, which in itself may be a small one; but the aggregate of all these efforts may be up to the limits of a man's ability. If we leave the question of the firing and handling the water supply to the boiler entirely with the fireman, we still have quite an array of items to be looked after by an engineer, in the way of train orders, signals of various kinds, keeping on the schedule time, air-brake work, and a score of other duties to be looked after while a train is in motion. If to this strain on an engineer's mind you add the work of taking a mental photograph of each drop of oil as it is used, you are liable to overload his ability. Better have his mind free from the ever-present fear of a hot box or cut journal when running between stations, as I know is the case when the oil economy is carried beyond proper limits, and allow all his abilities to be centered on the safety and despatch of his train.

How does this view of the matter strike you?

With the increasing duties and responsibilities being placed on an engineer with our modern engines and modern methods, it is wise to remember this precept:

"Do not overload the man at the throttle."

Bicycle Racks for Baggage Rooms.

The Boston & Maine station at Manchester, N. H., which, by the way, is a neater and more substantial station than you generally find in small cities, has a way of storing the ever-present bicycle which is worth noting. Fastened to the ceiling are iron hooks of the shape shown in the sketch. They are of such length that when the wheel is grasped by the head and saddle, turned upside down and raised over the head, the wheel rims drop over the hooks quite easily.

The wheels hang upside down, are easily taken down, and are out of the way. The hooks are spaced about 24 inches apart, and this room had accommodation for thirty wheels. The hooked ends were covered with rubber to prevent marking the wooden rims. It saves room, saves wheels, and is so cheap as to be afforded anywhere.

A Tall Stack.

We recently saw an engine at the Baldwin works with the tallest stack on record—for a locomotive. While the exact height is not known, it was in the neighborhood of 35 feet, and was liberally supported by guy ropes.

The cause of this was that a new boiler was needed in the forge shop, and to avoid delay they ran a spare engine up beside the shop, put on a tall stack for natural draft and let it run as a stationary boiler. It looked odd and caused many comments.

The Old Engine.

'Tis a long time ago since it made its first run,
And now it seems quite valueless;
'Twas way back, they say, in the year sixty-one,
When it carried the fast mail express.
But now it is old and covered with rust;
It has stood on a side track for years.
The smoke stack and side rods and brasses are lost,
As also are part of the gears.

But the trips that it takes in a make-believe way
Are many and wondrous, I'm told;
For it leaves the side track and returns the same day,
From Klondike with bushels of gold.
It travels to Boston o'er river and hill,
Or to any great place of renown;
For the wheels go so fast that they seem to stand still,
Through the make-believe city or town.

And the small engineer is a cherub-faced boy,
As he climbs to a seat on the side.
He clangs the old bell, pulls the lever with joy,
Says "Mamma, come, get up, take a ride."
He has mastered the names of the towns all along,
Of special importance and size.
May his trip through the world, as a man brave and strong,
Be in ways that are noble and wise.

MRS. M. C. ALLIN.

Cincinnati, Hamilton & Dayton Railway Shops at Lima.

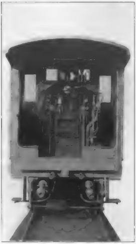
The Cincinnati, Hamilton & Dayton roundhouse at Lima, Ohio, was built years ago when a 16 x 24-inch locomotive was the full standard size. It makes a complete circle with only sixteen stalls and the passageway from the turntable in the center of the house to the yard tracks.

This turntable has been enlarged—with a new one—at various times till their largest locomotives can be turned on it; but on account of the other buildings the outside wall of the house could not be set any farther out. Therefore the engines, as they got longer, projected towards the table. In time the doors were set out further. This soon was still too short to house the engines, and as a last resort a dome roof was built over the turntable and the space around it, which was something like 90 feet in diameter, so that the engines are all under cover again.

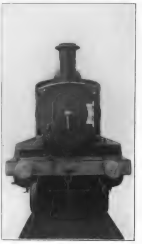
A general rearrangement of the shop buildings is now under way. The coach shops have been in operation for some time. They are fireproof buildings with steel frames filled in at the sides with brick and roofed with slate, well lighted and ventilated. They are heated with hot air from an American Heating Company blower that is located in the engine room.

The coach shop has nine stalls, all served by an electric transfer table. It is supplied with all the fixtures for expediting the work, except air hoists; these are ordered and will soon be installed. The upholstering and paint mixing rooms are in separate buildings. A commodious machine shop and a woodworking shop for car work is now in service. Sheds for freight car repair work are soon to be erected. There is a substantial brick building for boiler and engine room, centrally located. Hawley down-draft furnaces are used. So far as making smoke is concerned, the tall chimneys seem to be out of commission.

In the near future new shops for the locomotive work are to be erected, when the old buildings now in service will be taken for boiler and tank shops. About the same time a new roundhouse, built to conform to the wants of a modern railway, will put in an appearance, and the buildings at Lima will be second to none.



MIDLAND ENGINE CAB.



MIDLAND ENGINE, FRONT.

(Missed connection last month.)

Prejudice Against Midland Engines.

Under the heading of "Made in America" the *Railway Magazine*, of London, sends forth a wail that might be piteous if it was not so amusing. The first of the engines—the one we illustrated in May—is kindly termed "the ungainly assemblage of iron, etc., that will do duty on the Midland Railway as a good locomotive." The editor then cheerfully turns the term "mogul" into "mongrel" and is happy once more.

Probably the engines do look a little strange. The "1,320" of the Pennsylvania road—a Webb compound which was imported in 1889—was a queer looking bird from our standpoint, and lots of railroad men were just as free to condemn it as our friend of the magazine named is now. The engineers didn't like her either, and few of them ever took the trouble to work her to best advantage. But she proved herself a good engine in spite of adverse comments and petty jealousies, and we have no doubt it will be the same in this case. Steel is steel whether in England or the United States, and there are good engineers on both sides of the Atlantic.

Train Time Was Slow.

The following incident is said to have happened on a mixed train running between Wichita and Englewood, Kansas, where the time does not exceed fifty miles an hour—an R. P. O. a branch of the Santa Fé.

"Are we almost there, conductor?" asked a nervous man for the hundredth time. "Remember my wife is sick and I am anxious."

"We'll get there on time," replied the conductor stolidly.

Half an hour later the nervous man approached him again.

"I guess she's dead now," said he, mournfully; "but I'd give you something extra if you could manage to catch up with the funeral. Maybe she won't be so decomposed but what I could recognize her." The conductor growled at him and he subsided.

"Conductor," said the nervous gentle-

man after an hour's silence, "if the wind isn't dead ahead I wish you would put on some steam. I'd like to see where my wife is buried before the tombstone crumbles to pieces. Put yourself in my place for a moment."

The conductor shook him off and he relapsed into profound melancholy.

"I say you, conductor," said he, after a long pause, "I've got a note coming due in three months. Can't you fix it so as to rattle along a little?"

"If you come near me again I'll knock you down," snorted the conductor savagely.

The nervous man regarded him sadly and went to his seat. Two hours later the conductor saw him chatting gayly and laughing heartily with a brother victim, and approached him.

"Don't feel so badly about your wife's death?"

"Time heals all wounds," sighed the nervous man.

"And you are not so particular about the note?" sneered the conductor.

"Not now. That's all right. I've been figuring up and I find the note has been outlawed since I spoke to you last."—*Railway Mail.*

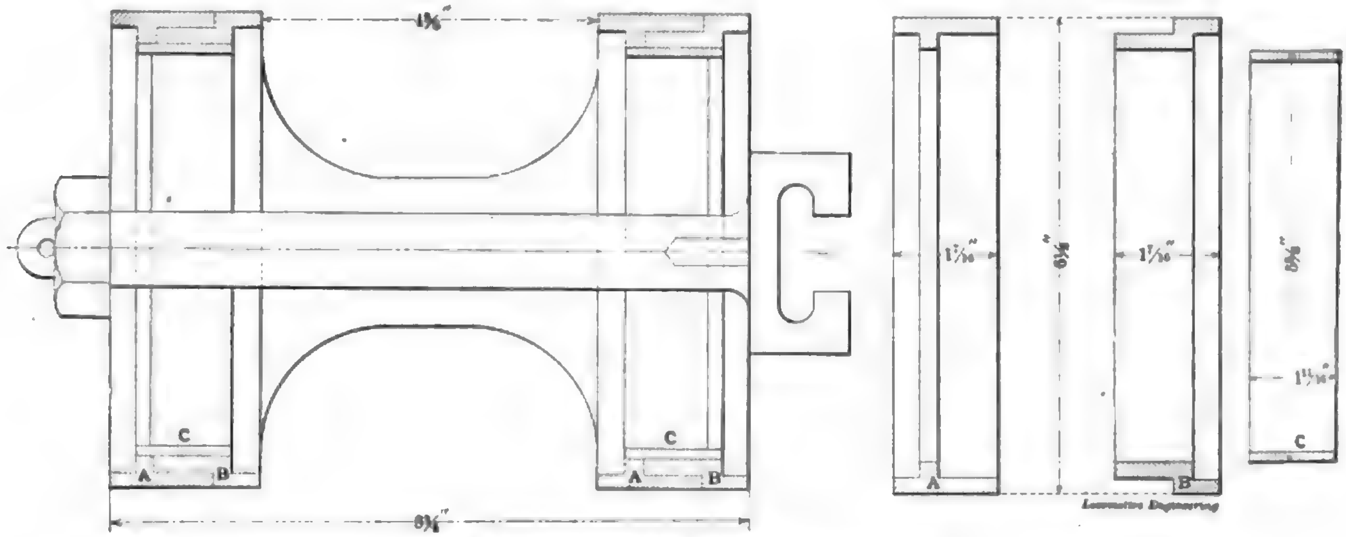
Handling Ashes.

At the Baltimore & Ohio Southwestern Railway shops at Chillicothe, Ohio, Master Mechanic John Hair has installed an air hoisting arrangement, which does this work very speedily and economically.

In the cinder pits are two large buckets, 3½ feet deep, 3½ feet wide and 8 feet long, into which the ashes are dumped or raked from the ashpans of the engines. They are large enough to hold the ashes from two and sometimes more engines. A crane stands between the cinder-pit track and the track for the cinder cars. This crane is operated by compressed air, both to hoist the ashes and to swing it around in position to dump the ashes or to return the empty bucket to the pit. The air cylinder for hoisting the bucket is 12½ inches diameter and 15-foot stroke. With 60 pounds of air it has a lifting power of about 8,000 pounds. The stroke is sufficient to lift the bucket out of a pit and over the edge of a gondola. Another cylinder, 8 inches diameter and 4-foot stroke, fastened at the base with a hinge, so it can swing to follow the movement of the crane, is used to turn the crane. Both these cylinders are just under the surface of the ground horizontal, so they are not in the way of the men operating it.

The valve for releasing the air from the hoisting cylinder has two release ports—one large to let the bucket down quickly to the level of the rail when the large port is closed, and the small one left open. This allows the men to swing the bucket around as it is slowly descending, so it goes square into the cinder pit. The bucket has a drop-bottom, in two sections, opening away from each other, so that the bucket is easily raised when being dumped.

This apparatus saves time, space and labor. Its first cost was very reasonable. It was installed at a point where the location of a depressed track for the cinder car was considerable of a problem, and all the tracks are close together and on the same level.



PISTON VALVE, FLINT & PERE MARQUETTE RAILROAD.

Hatswell's Original Piston Valve.

This piston valve was applied by Mr. T. J. Hatswell, M. M., of the F. & P. M. R. R., August 15, 1889, and is yet in service, having made 425,366 miles. The cages have been rebored and new packing rings applied once during this time. At present the valves are in good condition, and will run until engine is shopped. Mr. Hatswell claims it safe to estimate 500,000 miles as the life of these valves before they are worn out.

Improvement in Pennsylvania's Jersey City Station.

The Pennsylvania Railroad have had rather hard luck with their Jersey City station, but the two fires there opened the way for improvements which are now being made.

In common with most terminal stations, the waiting-rooms and offices were at the end of the tracks, so that all passengers must pass through them from ferry to trains. This made a long walk from ferry to train, and was inconvenient in other ways.

The present waiting-rooms are beside the train shed, so that no one need go into them unless they wish to buy tickets; and as most tickets are bought on the New York side, this is a convenience for the majority of passengers, as it is a much shorter distance from ferry to train than before.

With the waiting-rooms at the side, the train shed has been extended almost to the river, and the trains now run that much nearer the ferry. This has been done by moving the end span of the arch, with its end window framing, bodily 125 feet toward the river, filling in the space with new spans.

It is something of an engineering feat to move an arch with a span of about 260 feet and weighing 450 tons in this manner, but Pennsylvania engineers have a habit of doing these things, and doing them right. Both ends must be moved alike, and care must be taken to prevent the arch tipping, for it is a high one. But it was done, and no more need be said about it.

They have also raised the grade in the station about 3 feet, to assist in stopping in-bound and starting out-bound trains. It seems like a little thing, but it is attention to these that makes up a successful whole.

Schenectady Engine for Delaware & Hudson.

We show herewith a Schenectady locomotive of recent construction. Most of the details of the Delaware & Hudson Canal Company consolidation are shown in the diagram on next page, but in addition are the steam ports, 18 by 1¼ inches, for the steam, and 2¾ inches for the exhaust. Valves are Richardson balance, with no inside lap and no lead in full gear. Cast-steel wheel centers and driving boxes are used. The boiler is double riveted on circumferential seams, and sextuple riveted with welt strip inside and out on horizontal seams. The crown is radial stayed with 1⅛-inch stays. The computed tractive power is 31,000 pounds.

The engine has two No. 10 Monitor injectors; Jerome packing; American outside equalized air brake on all drivers; Westinghouse automatic on tender and for train; a 9½-inch air pump; two Crosby 3-inch muffled safety valves, and a 6-inch Star chime whistle. This is one of fifteen, and they are doing good work.

SCHENECTADY ENGINE FOR DELAWARE & HUDSON.

Liquefied Air and Liquefied Steam.

The English daily papers—one of them at least—have been let loose on liquefied air. I have noticed for some time since the death of the late lamented Keely that on your side there was a void to be filled. This would be a poor world but for perpetual motion. If we are to believe all we hear of Mr. Tripler, he has stepped into the shoes of Keely, for he has invented a machine for compressing air, which, once it has been induced to manufacture about 3 gallons of it, will continue ever after to manufacture liquid air until the brake is applied to stop it. Now this same liquid air has slopped over the Atlantic, and has been worked up by a daily paper for all it is worth. Water and steam power have been relegated to a back seat, and there is to be no further use for coal; and even electricity, which we all know costs nothing to make, and was soon going to put a stop to such archaic things as steam engines, is also to be put on the shelf. All this, which is absorbed by the average reader as so much gospel, is painful evidence of the great ignorance of first principles which possesses most people. If we take steam and put it under pressure, we shall cause some of it to liquefy. If at the same time we abstract from it some of its heat by means of some less hot body, we shall perform this duty of liquefaction with much greater ease, and we can with the command of a sufficient amount of heat-absorbing material liquefy practically all our steam without exercising upon it any pressure whatever. I have myself manufactured many tons of water by liquefying steam, and by again applying heat I have succeeded in again vaporizing the liquid steam and generating power by the use of the enormous expansive force thus set free. I have applied this force to turn machinery for the grinding of corn, for the spinning of cotton and for drawing vehicles along rails. Is it not marvellous! Yet no one gives me any credit for doing this. I am told that the principle has been known for years, and that my results are only an improvement on some results obtained a century ago by some fellow named Watt, and that Watt would have done just as well as I can do, but he did not have the appliances which I can command.

Yet here comes Mr. Tripler. In place of a chemical combination of oxygen and hydrogen Mr. Tripler takes a mechanical mixture of oxygen and nitrogen, having practically identical properties with my steam gas. The only substantial difference between his gas and mine is that the properties I have described as connected with my gas are exercised by his gas at temperatures much lower down the scale. In other respects there are no real differences. Such difference as there is demands machinery of more accurate make and stronger, for an equal result, than my machinery. There is also a far less choice of cooling materials than I am able to make use of. On one occasion, indeed, I employed the South Pacific Ocean—not all at once, but just any part of it which happened to be at hand at the moment. In this respect, therefore, my practice is wider and more general than that of Mr. Tripler. In no way, then, can he claim an advantage over my system. I see that he can carry his liquefied air in milk cans. Well, what if he can? Our milkman gives away a quantity of liquefied steam with every quart of milk he leaves at the door—says it enables him to sell cheaper, and it seems to have the valuable property of preventing some of that fatty material from collecting at the surface of the milk, if left standing for an hour or two.

Liquefied steam has many other advantages. At its usual temperatures it may be drunk without danger, and there are thousands of uses to which it can be put for which liquid air is unsuitable. As to power-production, liquid air is not in it. Why, then, all this fuss about liquid air? as though Mr. Tripler had discovered a new principle. He has possibly improved the apparatus for liquefying air, but here his useful work ends, and his liquid air can only have a very limited application; and when once vaporized, cannot be returned to the liquid state except by great expenditure of energy. Its use, therefore, must demand a great expenditure of fuel, and after all he must employ my liquid and my motor to produce his liquid. Yet the papers are full of Tripler, and say nothing of me. Is this because Tripler promises perpetual motion and I don't? Looks like it.—W. H. Booth, in *American Machinist.*

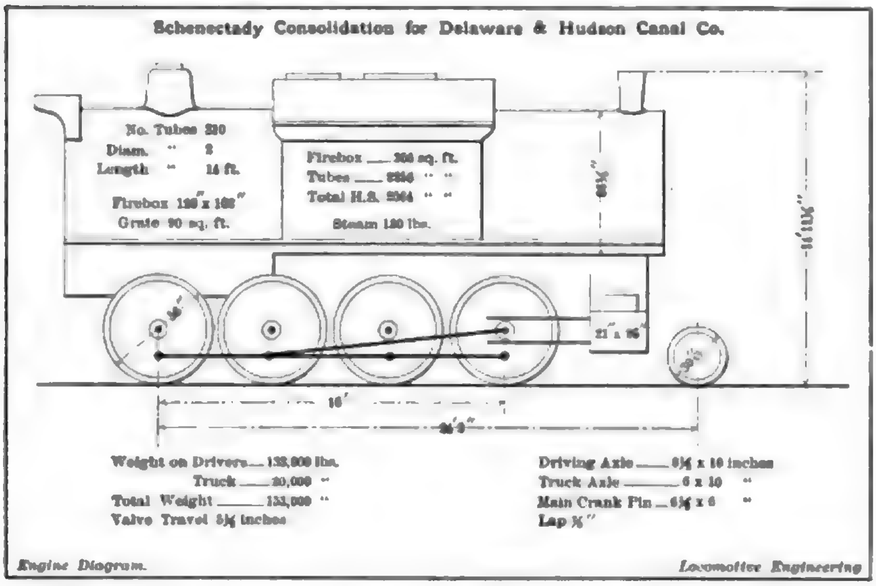
Railway Equipment.

Advance sheets of the Interstate Commerce Commission's Report for the year ending June 30, 1898, say:

"On June 30, 1898, there were 36,234 locomotives in the service of the railways. This number is larger by 248 than the previous year. Of the total number of locomotives reported, 9,956 are classed as passenger locomotives, 20,627 as freight locomotives, and 5,234 as switching locomotives, a small number being unclassified. The total number of cars of all classes reported as in the service of railways on the date named was 1,326,174, being an increase of 28,694 as compared with June 30, 1897. Of the total number, 33,595 were assigned to the passenger service and 1,248,826 to the freight service, 43,753 being assigned to the service of the railways themselves. The number of cars owned by private companies and individuals that are used by railways in transportation is not covered by reports filed with the Commission.

"An inspection of the summaries which are designed to show the density of equipment and the efficiency of its employment, shows that during the year ending June 30, 1898, the railways in the United States used 20 locomotives and 718 cars per 100 miles of line. Referring to the country at large, it appears that 50,328 passengers were carried, and 1,343,906 passenger-miles were accomplished per passenger locomotive, and 42,614 tons of freight were carried, and 5,530,498 ton-miles accomplished per freight locomotive. All of these items show an increase as compared with those of the previous year ending June 30, 1897.

"Including under the term equipment both locomotives and cars, it is noted that the total equipment of railways on June 30, 1898, was 1,362,408. Of this number 641,262 were fitted with train brakes, the increase being 115,976, and 909,574 were fitted with automatic couplers, the increase in this case being 230,849. The summaries indicate that practically all of the locomotives and cars assigned to the passenger service are fitted with train brakes, and that out of a total of 9,956 locomotives assigned to this service 5,105 are fitted with automatic couplers, and 32,697 cars out of a total of 33,595 cars in the same service are also so fitted. A corresponding statement for freight equipment is as follows: Out of a total of 20,627 locomotives assigned to the freight service 19,414 are fitted with train brakes and 6,229 with automatic couplers, but out of a total of 1,248,826 cars assigned to the freight service only 567,409 are fitted with train brakes and 851,533 with automatic couplers. The number of switching locomotives fitted with train brakes was 3,877, and the number fitted with automatic couplers was 1,199. Of the total number of cars of all classes in service on June 30, 1898, 607,786 were fitted with train brakes, the increase during the year being 115,227, and 896,813 were fitted with automatic couplers, the increase in this case being 227,876."



Another Hero.

The heroes of railroad life appear to stand forward every time when the call for bravery arises. The latest of the many deeds worthy of the admiration of mankind is thus reported in a recent dispatch from Vancouver, B. C.:

"Harry Honey, a watchman of the Canadian Transcontinental Railway, on the Cherry Creek section, prevented a serious disaster on Sunday morning. About midnight on Saturday the Cherry Creek bridge caught fire and was destroyed. Honey and his wife were the only ones within fifty miles of the place. Coming west toward Cherry Creek was the limited express, and approaching eastward was the excursion train carrying 400 American journalists on their return trip.

"The stream was swollen by heavy rains and the current was swift, but Honey knew that the only way to save the excursion train was to swim across and reach the signal station on the opposite side. He started out, and after a hard struggle succeeded in making a landing on the opposite bank.

"He reached the flag station, 900 yards distant, and signalled the train, which was rapidly approaching. When the women journalists on the train heard of Honey's heroism they crowded around to shake hands with him, and some of the men pressed him to take money, but Honey refused. He wanted to return quickly to flag the train on the other side, but fainted from exhaustion before he could reach the burned bridge, and meanwhile his wife had flagged the limited."

The Guayaquil & Quito Railway Company, Box 37, Guayaquil, Ecuador, South America, would be glad to have catalogues of concerns manufacturing any and everything used in the construction, maintenance and operation of a railroad.

The Mason Regulator Company, of Boston, have sent us a neat catalog of the Mason governor. This tells the story of its success in a few words and shows its construction and application very clearly. Several letters of commendation are also given which simply add to the proof of its popularity.

Siberia is ahead of this country in some things, according to John W. Bookwalter, who says: "At every station on the railway there is placed in front of the station, at a point convenient of access by the passengers, a large cask of cool water that has been boiled, and it is the duty of the station master to see that the supply is kept up. This is free to all passengers, even to the poorest emigrant, whose comfort and welfare are provided for in many ways with thoughtful care."

Liquid hydrogen, which is the great agent now discovered, is described as a clear, colorless, transparent and very volatile fluid, no clearer than pure water, but only one-fourteenth the density of water. In its lightness it is out of all proportion to any known liquid. A piece of paper when placed in it sinks. The difference between liquid hydrogen and liquid air is as great if not greater than the difference between the ordinary temperature and liquid air. Liquid hydrogen places temperature at within twenty degrees of absolute zero, which is represented by 494 degrees Fahr. and 273 degrees Centigrade below zero. The boiling point of liquid hydrogen is 252 degrees below zero, at which it is capable of enormous pressure.

General Correspondence.

All letters in this Department must have name of author attached.

What Causes Flat Spots on Tires.

I have read in the June number the article on "What Makes Flat Spots on the Drivers?" Mr. Kingan claims that the speed has nothing to do with flattening of tires, but claims that it is the slip of the wheels. Now, I think every observing engineer has noticed that an engine will slip working hard while right side is leaving lower quarter; but if that made the flat spots, all tires would be flattened the same, as all wheels are connected, which is not the case, according to my experience and observation.

The road I am employed upon has a large number of Baldwin engines, 17 x 24-inch cylinders, 5-foot wheels. Now, these engines are all alike, and they will run on freight for two years between shopping without flattening enough so you can notice by riding on them. The same engines on passenger trains, in making about 60,000 to 70,000 miles, will have very bad spots on left side, especially on forward drivers, and will show scarcely any on right side of engine.

I have observed that engineers who run with wide-open throttle with engineer's lever in first notch, will flatten wheels quicker than some who do not use quite so much throttle and use reverse lever a little more. The writer fired engines twenty-five years ago for some of the old-time runners who never were known to run with reverse lever higher than the third notch, and the engines would run so long between shopping that the tires would be very badly worn; but never knew them to flatten. But the writer has run the same engine on passenger train at greater speed, and worked higher on quadrant, and she would flatten tire same as the modern engines of to-day. I hope someone will let us know what makes flat spots on drivers.

R. T. Stafford.

Minneapolis, Minn.

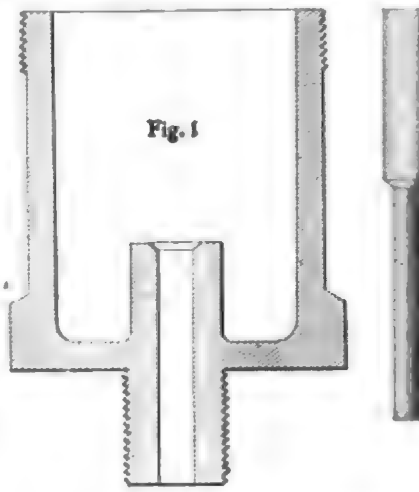
Hot Bearings and Good Oil Cups.

BY EUGENE M'AULIFFE.

The old saying that "the best engine in the world is a poor one if she does not steam," is a true one, and next to the poor steamer is the engine that is continually troubled with hot pins and boxes.

Hot bearings, like the poor, we will always have with us; but the minimum number is the goal we are striving toward. In discussing this matter we will not speak of the flyer with 84-inch drivers and 54-inch truck and trail wheels, but rather the more common type of engine of from 40 to 60 tons weight and 54 to 60-inch drivers—the class that pulls the greater number of trains moved on American railroads. Granted that rod, driving and truck brasses are of the best material and fitted properly, then comes the question of lubrication, an item of the utmost importance. In regard to main pins, I am confident that their greatest enemy is defective lubrication, or rather the defective application of lubricants.

I am an advocate of the use of cylinder oil on main pins, believing it the most economical; and to those who urge the use of engine oil instead, on the ground



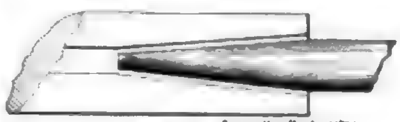


Fig. 2

M'AULIFFE'S OIL CUP.

that cylinder oil will not flow in cool weather until heating commences, I beg to call their attention alike to the grease cup and their particular style of rod cup. Cylinder oil will feed in the coldest weather with the right kind of cup, and engine oil will not carry main pins that a heavier oil will. The requisite quality of a good rod cup is that it will feed a small quantity of oil, and that constantly. To insure this last feature, the feed must be a forced one, and the straightwire or Dreyfus feed is not a forced feed, but is a combination of gravity and viscosity instead. A small particle of dirt, a flake of babbitt, the minute thread of brass broken off the shank of the cup, often serves to stop its motion, and a hot pin is the result.

The light screw or rivet style of feed is even more pernicious, as screwing down the cover often hermetically seals the cup, causing a shortage that soon becomes manifest.

Fig. 1 shows a rod cup that will feed. The plunger, by virtue of the valve seat at top of post, is loose enough to escape the jamming of foreign particles that the Dreyfus feed is subject to, and, in addition, the weight of the large end will cause it to lift in the coldest weather, and in every case a small portion of the oil caught between the shoulder of the plunger and its seat must go down. This valve joint admits of a loose fit in the post, and with a screw and jam-nut in the cover there need be no trouble in regulating the feed by the lift.

If this style of feed errs at all, it is on the side of an increase in cold weather. Where engine oil is used, the needle feed is the best, provided that the tapered bearing surface of the needle is from 1¼ to 1½ inches long, and which if pushed down would bear evenly its full length in the post, as shown in Fig. 2. A short, blunt needle is a delusion and will never give good satisfaction, an extra tightening of the cover often altering the opening 50 per cent. In all cases the oil used in filling cups should be carefully strained. When a hot pin develops, every engineer has his favorite remedy—sulphur, soap, salt, lye, graphite, etc. Lampblack I believe to be the best of all; it is a slow grinder—in fact, more of a polisher—and, being almost pure carbon, will stand a very high temperature. Neither will lampblack shrink or discolor brass, but, on the other hand, will probably do more to correct mechanical inequalities than any other dope that can be used. In regard to driving boxes, I think that defective hub bearings are answerable for a great deal of trouble. I have noticed that the greatest number of hot boxes occur to those wheels that carry the blind tires, regardless of their location. I can only account for this on the ground that the crowned surface of blind tires leads them to follow the unfortunate predisposition that a great many engines have, to run to one side or the other, and, as a matter of course, the more they run to that side the more they want to. I recall a class of 19 x 26 moguls that chronically suffered from hot boxes on the main drivers; they carrying the blind tire, the heating spreading from the journal to the eccentrics, until the valve oil can was kept busy. Another class of ten-wheel engines with same cylinder suffers 75 per cent. of their hot boxes on forward drivers, they also carrying the blind tire.

In both instances the road was extreme-

ly crooked, with curves as short as 6 degrees. When a box is receiving sufficient good oil, and which is packed in such a manner as to supply the journal regularly, and excessive heat develops, it is reasonable to argue that some abnormal condition exists, such as hard, coppery spots in the brass, a seamy journal or the presence of too much grit and dirt. If serious delay to the train would be avoided, something more radical than oil is needed to keep the journal from growing hotter. To this end I am an advocate of cold water as a means of carrying off the heat. To the mistaken impression that pure water is a lubricant can be attributed most of the abuses that result from its use. Water without an admixture of oil of some sort simply cleanses the rubbing surfaces, and a rapid cutting results. All engineers are familiar with the fact that a dew or light fall of rain makes a slippy rail, while a heavy rain thoroughly cleansing the track gives the highest possible degree of adhesion. So it is with water applied to bearings. When used in connection with oil, the water keeps the heat down, while the oil keeps the metals separate. The proper application of water is made by way of the cellar, oiling freely from the top; and if used in time, all cutting, shrinking or distortion of the brass can be avoided. Water, however, will not refit a burned-out bearing, and in no case should it be used as a substitute for oil or proper attention.

Perhaps it is needless to say that water drawn from injector frost cocks at 250 degrees temperature will not answer the purpose; cold water is what is wanted.

Springfield, Mo.

A Point in Freight Car Construction.

BY WM. J. KNOX.

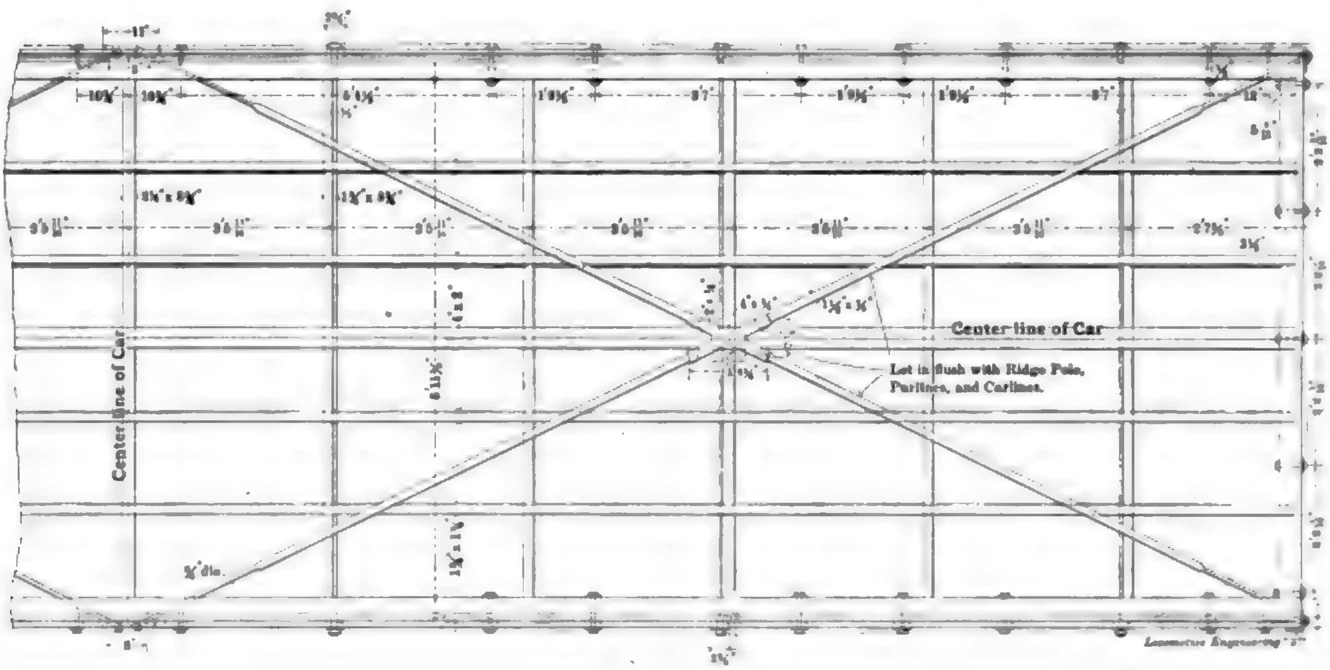
In the effort of railroad managers to effect economy in operation and increase revenues, one line of attack has been directed toward decreasing the deadweight of cars in proportion to the carrying capacity. This and the struggle of competing lines to control the transportation of special commodities have been the means of rapidly bringing into service cars of immense size and ever-increasing capacity, until now coal or gondola cars of from 80,000 pounds to 100,000 pounds' capacity are common; special cars for furniture, woodenware, etc., are of 50 feet and upwards in length, 8 feet 6 inches to 9 feet in width and height inside, and of 80,000 pounds' capacity, while box cars may be found of 100,000 pounds' capacity.

These enlargements have brought in their train necessary modifications in construction, and many new designs and improvements have been made in trucks, the truck and body bolsters, draft gear, etc., and much has been written as to the most advantageous spacing of sills and body truss rods. Necessarily and properly the foundation frame has received most attention, though in some details the superstructure has been looked after, but in one particular at least, viz., the lateral stiffness of the frame and roof many cars now in service and being built are deficient. This applies more especially to long cars of great height and width.

The braces divide the side walls of the car into triangular sections so that longitudinal racking of the frame is all but impossible, in like manner the end walls are maintained square laterally with the end sills, but the roof frame, as usually constructed, is made up entirely of rectangular sections.

The car is in service but a short time when from shrinkage, unequal loading, etc., the side frames, from the sills upward, are racked out of line. On roads where coal is habitually transported in box cars this racking is especially noticeable.

The writer has seen a 38-foot furniture car so loaded that the roof was racked 4½ inches out of plumb at the center, and while it probably illustrates an extreme case of this kind, observation will show that distortion of this character is common to the great majority of cars, more especially large ones, and is no doubt responsible for much trouble from leaky roofs.



FREIGHT CAR ROOF FRAMING.

Diagonal tie rods in the roof frame from the corners to the center of car, or diagonal braces would certainly in a large measure overcome this defect. In some of the plans for metal car construction such braces have been provided, and a few wooden cars will be found so built. An examination, however, of late designs from about a dozen leading roads, covering box and furniture cars from 36 feet to 50 feet in length, disclosed in one case only such braces.

The writer believes that when the present crop of large cars shall have been in service a few years the lack of such bracing will be more apparent.

Fig. 1 is the roof plan for a 40-foot 80,000 pound capacity box car of recent design where diagonal ties are provided. As will be seen they are of flat iron riveted to center crosses at ridge pole, and formed with round ends, with nuts tightening against malleable iron washers on outside of fascias at center of car and

at corners. The ties follow the angle of roof and are let in flush with carlines and purlines. In this way they do not interfere with roof plates, nor are they conspicuous inside the car. A carline is located centrally under the cross-piece, and is increased in section to provide for such downward thrust as tension of the members may transmit to it.

A Talk With the Firemen.

The day is fast approaching when the men holding the positions on the left side of our locomotives must be scientific firemen. You will say, "What do we know about science?" I will ask, What can you learn? As one of the professors in our public school used to say, always spell can't with three letters—t-r-y.

Now boys you know that coal or carbon will burn when it is heated to a temperature that will cause the oxygen of the atmosphere to unite with it. This is taught us by chemistry—a science. It is to study by practice the exact amount of carbon that is needed to supply the oxygen that is being taken into the firebox through the grates to maintain a certain temperature that the modern method of firing is trying to accomplish.

This cannot be learned in one day, for some of the best chemists have labored for months on the proper unison of certain gases to produce a certain kind of material.

Our railway managements are conservative and do not expect impossibilities, but they know that if the coal is furnished regularly and in the exact amount that there will be almost perfect combustion, the coal account will be reduced to the minimum and there will be less cause for complaint from the traveling public.

Regulate your firing like the lubricator is regulated; make yourself a mechanical fireman, but add the intelligence of the conditions with your actions.

A great many firemen after getting their fire started when they are beginning to learn the one-shovel practice, wait too long or until the fire is burned too low before they begin with the one shovel, with the result that pressure cannot be kept up. Begin while the stack is emitting a light spray of smoke, and maintain this white-looking smoke. If you find you can space your fires a little further apart you will reduce the amount of smoke and color also.

Whatever the nature of your coal, you should try to maintain it as near the same grade as possible. But, you will say, we use a run of mine coal varying in size from dust to hoosier pumpkins.

If, when you have broken your coal, a shovelful of slack is thrown on it, and a couple of turns of the shovel is made, as the street builders mix their gravel and cement, this will consume the coal and slack at the same time, and a similar grade can be maintained throughout the trip.

Do not worry about the bell being rung, or watching for the hind end around left curves; the company will provide for this when they see you are making an effort to fire economically.

If you are on fast scheduled train that must be terminaled on time, do not let it be said you "fell down" on steam. If you don't fire with one shovelful but five miles the first day, select a level piece of road or where the time is easiest made, and experiment. Do not let the pressure get so far back you cannot increase it. If you fail the first day, try a little differently the next. You fellows who have been using six and eight shovelfuls to a fire, I would most emphatically recommend a reduction of 5 per cent. at once; then gradually reduce over portions of the road, that experience will teach you, until you have reduced the amount of coal consumed to a minimum over the entire division.

The days of the coal-shoveler on the railroads are numbered; and if you expect to get to the front, or rather on the right-hand side, *be up to date.*

W. J. Torrance.

Evansville, Ind.

Defective Draft Arrangements.

On the system for which I am employed, as well as the majority of the roads in this country, the officials are endeavoring to curtail expenses by practicing the strictest economy in the consumption of supplies of various kinds. Among the rest the coal consumption is coming in for a great amount of attention, and naturally those making a poor coal record stand a good chance of being "jacked up" by the powers that be. It must be conceded that by careful handling of an engine, with a due regard to the laws that govern combustion, far better results can be obtained by an engineer than if he was careless in these particulars. Yet I claim that many a good, careful man gets blamed for having a poor coal record, when in reality the blame lies with the defective arrangement of the draft appliances in the front end.

Chief among the defects which have come under my observation, are exhaust pipes out of line with the stack. When an engine leaves the back shop, it is the practice, at a number of points where I have been located, to jack the engine up level, then drop a plumb line from the center of stack saddle, and if it is true with the center of exhaust base, everything is supposed to be O. K. The exhaust pipe, nozzle and stack are put in place afterwards, and if any of these are but a trifle out, it makes a serious difference by the time the exhaust steam reaches the top of stack, and it is impossible to get good results from an engine under these conditions. I remember well on one occasion when the mogul engines began to come into general use, getting one new from the shop, and after struggling along for a few trips trying to haul a train without steam, besides burning up all the coal we could pile on the tank, the exhaust pipe was "booked" to be put in line with the stack. The result was, it was found to be out about ⅛ inch at base, which on being rectified resulted in us getting not only lots of steam, but also effected a saving of about 50 per cent. in fuel. I consider that the proper way to test if exhaust pipe is in line is to level up engine, see also that nozzle is perfectly level; then if a line run from the exact center of top of stack is dead in line with center of nozzle, then, and only then, is exhaust pipe true with stack.

Again, it often happens that the exhaust pipe is too long, and, in consequence, the exhaust steam fails to expand sufficiently to fill the stack before it reaches the top; thus failing to create a vacuum and give a perfect draft. The engine is reported as steaming poorly, and the trouble may be overcome by putting a bridge in the nozzle, thus giving the steam enough spread to fill the stack; but this can only be done at the expense of the coal pile, besides increasing the back pressure. In my experience with engines having cylinders 18 inches in diameter, or greater, the best results are obtained by having the top of nozzle not less than 30 inches from top of smoke arch, with either one or two petticoat pipes, which must also be in perfect line with the stack. When two petticoat pipes are used, the barrel of the lower one should be about 10 inches in diameter, with a flare of from 16 to 17 inches, and should be set about 1 inch above nozzle. The barrel of the upper pipe should be from 2 to 3 inches wider than the lower one, with the same flare, and set about 1 inch above the lower one and clear of smoke arch about 2 inches at top.

The stack itself is an important factor in the steaming qualities of an engine, but with an arrangement as above a stack about 52 inches long and 16 inches in diameter gives very good results.

When the diaphragm sheet is between the steam pipes and the flue sheet the hot cinders lodge around the steam pipe joints. The front end draws in more or less air; the heat around the joint is sometimes excessive, causing undue expansion and contraction, resulting ultimately in leaking joints, which may run some time before they get bad enough to be detected and remedied, thereby causing another waste of coal.

The remedy for this is simply to move the draft sheet to the front of the steam pipes when the hot cinders will be drawn forward into the extension where they belong, instead of forming a furnace around the steam pipe joints.

Another great drawback to a perfect draft is the fine netting that is put in front ends to prevent the emission of sparks.

Not only is the netting itself a serious obstruction to the draft, but owing to the web being so fine the greater part of it quickly chokes up, leaving but a small space for the exit of the gases. As the engine fails to steam the nozzle is reduced with the resultant evils of tearing up the fire and increasing the back pressure. At the same time the benefit of the fine netting as a spark arrester is greatly neutralized owing to the increased draft on the fire, thereby throwing out small particles of blazing coal which, with a softer exhaust, would have stayed in the firebox until entirely consumed. Where very fine netting is used it is my opinion that it would be wise to replace it with a coarser grade, provided that all the other arrangements in the front end were in perfect trim. Then the engine would steam so much more freely that we could use a larger nozzle, and so reduce the tearing action on the fire that the emission of sparks and the consumption of coal would be reduced to a minimum.

A. M. Stewart.

Vicksburg, Miss.

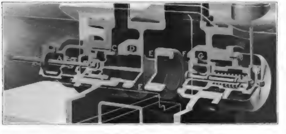
The Intercepting Valve of the Schenectady Compound.

BY C. R. PETRIE.

Compound, as used in steam engines, means the second use of steam, or expansion in a second cylinder. After expansion in a small cylinder the exhaust is introduced into a larger one and used to do work upon a larger piston area before it is exhausted to the amosphere.

The small cylinder is called high-pressure, because steam is admitted at a high pressure from the boiler. The large one gets the steam after it has done its work in the small one; therefore it is at a low pressure. In some stationary engines a compound is fitted with a small pipe, taking live steam from steam pipe to low pressure steam chest, called an overpass. In this pipe there is a valve which the engineer can reach readily, which he uses before starting to warm the large cylinder, or help engine off of center, in case high side was on that point.

Now, in locomotive work both engines should receive steam at once; therefore, the overpass should be made to work at all times when starting the engine, and should be opened without the extra valve. It must close just at the right time, as will be explained. Now, say we connect the high-pressure exhaust pipe to low-pressure steam chest. The overpass is opened at the same time the throttle valve is, and the steam would pass into steam chest down into low-pressure cylinder, but it would also pass back through the exhaust pipe from high-pressure side, and that would not do. Therefore, we must close up the exhaust pipe from the high-pressure side until we wish to close the overpass. When we close the overpass we want to have the exhaust steam from the high-pressure side take the place of the wire-drawn overpass steam in the low-pressure steam chest, and we want it to be at about the same pressure. In my last paper I described Mr. Pitkin's old style intercepting valve. This time I will describe his new style, which is just the same as his old one, except in better shape. He also has introduced a reducing valve which will reduce. He has placed the small live steam pipe inside of smoke arch instead of bringing it outside at rear of saddle; thereby he gains, for the loss of steam is less on account of the superheat of smoke arch. In looking into the smoke arch of the new style you see the large pipe curved from one side to the other the same as before, except this pipe has ribs cast into it extending lengthwise. This is done to help in superheating the steam that passes through it, as in being built this way the pipe gathers more heat as it passes to the stack from the firebox. This large pipe is the exhaust pipe from the high-pressure side to the low-pressure steam chest, and is called the receiver.



INTERCEPTING VALVE OF SCHENECTADY COMPOUND.

Behind this pipe, on the left side, you see a large pipe leading to left steam chest from nigger-head; this is the main steam pipe. On the right side you see a small pipe, direct into saddle from nigger-head; this is the live steam pipe to low-pressure chest, same as the small copper pipe that comes out at rear of old style.

Now let us look into the cylinder that is cast in the saddle on right side. We will take off this small cylinder *A* (dash pot) by removing the head at back of saddle cylinder, take key out of piston, and lay this part to one side. The next thing take out this bushing and the intercepting valve. We find that this cylinder extends the entire length of saddle from back to front. Taking off the forward head *B* we have another small cylinder, a cage, and two valves that fit with a taper to the cage.

Laying this to one side, we start in at the back of saddle again. The first opening we come to in cylinder is located a few inches in and at the top; it is about 4 inches across and 1½ or 2 inches in length. This opening *C* is where small pipe from boiler enters. A short distance farther in we come to five or six small openings cored out in a circle *D*. This is opening to low steam chest, where live steam passes from *C* at certain position of intercepting valve. Still farther in we find a large opening at top and bottom of cylinder, opposite each other *E E*, and farther on there is another one at top and bottom *F* about the same size.

These openings are where the receiver pipe is connected and the exhaust steam passes through the saddle to low steam chest. At almost the extreme forward end there is another opening *G*. This one is where we can, when desired, make an exhaust opening for high side, as it leads out to exhaust stand pipe.

Now take up the valve. You see at the forward end the two plain disk valves, about the same as the old ones, except they are hollow part of their length, and the forward one has a large piece cut out at the top. On the back one there is a set of snap rings that fit the largest part of cylinder. Just back of the rings in the disk we find the small openings, in a circle corresponding with the ones we found second in the cylinder. This valve or disk is hollow at the back end; the forward one hollow at the forward end. The back one is not entirely hollow, but stayed, and at the back and center is a small lug with a cup-shaped brass valve working on it. Now pay attention to this valve. When back as far as it goes, it closes the end opening to the hollow disk; when full ahead, it opens that opening but a short way. Also notice the back part of this valve has snap rings, and is steam tight, making a small dash-pot at that end. You will see a small opening to atmosphere through the next head from this pot. Therefore the forward area of this valve is large, the back head small.

We leave this valve for a moment and pass on to the third or back head. We find this head with snap rings; but this head is much smaller in diameter than where the rings were on the disk ahead

of this one. We take this bushing and place it in the cylinder, and the back head rings just fit it; therefore the back end of cylinder is smaller than the forward.

We put on our cylinder heads again and try her. First, let us pull the stem entirely back. This opens the large openings from receiver to low-pressure chest. Now the opening where live steam comes in, at *C*, is between the large diameter snap rings on the disk ahead, and the small diameter snap rings on the back head. Open the throttle valve. Steam passes down through main pipe to high-pressure chest, and at the same time through *C* to the opening between these two heads. One head being small and the other a large diameter, the steam will push the large one away or ahead. As these valves move ahead they close the two large ports from receiver and low-pressure chest, and intercept the steam from both ways. Just as they close, the small openings in the back disk come into position opposite the same openings in the circle of the saddle. At this time the same steam pushes the small brass valve ahead and passes into low-pressure steam chest. This steam is wire-drawn in passing, so the large main piston gives about the same power at the pin as the small main one does. Now, if the engine starts off and uses the steam, this small valve will stay open, but if engine stand still with throttle open the pressure in low-pressure chest will rise. As it comes up it will, on account of the large area on the forward side, close this small valve up against the incoming steam.

In the old style, when the steam became too high, the relief valves at the end of cylinder and chest would open and let out the excess. These relief valves are used yet, and at any time if they should start to blow (when set to proper weight), you can know that the reducing valve is stuck open or back disk broken out at the end. When engine starts off and makes a few strokes, the high side exhausts into this large pipe, which, being closed at one end, makes a receiver of it. As she exhausts into this pipe, the pressure comes up, say, from atmosphere to 80 pounds. On the forward end of the disk valves we have this 80 pushing against, say, 150 pounds on the back end of the disk. These being the same diameter, or nearly so, 80 pounds would not move the intercepting valves back or open, against the higher pressure. But we have the back piston head, that has this assumed 150 pounds against it also. The diameter of this head is small, but with the help of the 80 pounds it will pull back the disk valves, close the live-steam openings, and allow the 80 pounds to take its place in low-pressure steam chest, and do work in the large cylinder. As long as the engine is working in this way (compound) the 80 pounds holds open the intercepting valves against live steam coming in at C while throttle valve is open. You see then there is only one way to cut this engine in straight or simple; and that is, to do away with the 80 pounds that is holding the valve in compound. To do this they have placed on the forward end of this cylinder in the saddle, a small cylinder with piston. When air or steam is admitted the piston moves ahead and opens first a small valve, allowing the 80 pounds in receiver to start through the opening nearest the front of the saddle to the exhaust stand. The small valve opening is in center of a larger one the same shape. As piston travels to extreme, the large one is pushed open, making an opening for high-pressure exhaust to atmosphere. When this steam is released, the pressure goes down in receiver and the 150 pounds of live steam shoves the intercepting valve ahead again, and the engine works simple. Now open the small valve in cab again, allow air to exhaust from small cylinder, and a spring on the small piston closes the two valves again and up comes the steam pressure in receiver and pushes the valve back into compound. In pushing these valves back and forth, they would slam and break at end of stroke, so they have put this small cylinder at rear of saddle, with connected piston head, made a small opening from one end of cylinder to the other, filled it with oil. When a movement of valves is made to intercept or open, the oil has to flow through the small opening to other side of piston head. In the small opening there is a plug that can be set to regulate flow. This saves slamming, or, in other words, cushions the valve. Sometimes throttle will leak when standing still and fill receiver after a time. Do not think, when you come to start, that throttle valve is disconnected if small reducing valve should stick shut.

Now we know how and when the intercepting valve works, and from it we know how to disconnect, or how to get engine in, in case of an accident. Breaking down on high side or left side we know we have two ways to get steam from boiler to low side. One is through main steam pipe to left chest through exhaust port to receiver and to chest. This can only be done by blocking the intercepting valve back, and is a poor way, as it gives too much pressure for the large cylinder. Therefore, block main valve to cover ports on left side, take down that side as you wish, get on and go. You will get enough steam through the small pipe. If the right side is to be taken down, cover the main valve on that side, open the atmosphere valve or exhaust valve by admitting air through small valve in cab to small cylinder in front, and go. Care must be taken to cover ports well. One of the saving features of these engines is the expansion in the second or large cylinder. To get this do not expand your steam too much in the first one. Work your lever well down to get this result. Another feature is less condensation in the cylinders than in a straight engine. The cylinder walls and piston head cool at each exhaust from nearly boiler pressure to atmosphere at each stroke, and when the steam enters the cylinder again at each stroke these walls and head have to be heated again. The steam used to heat them turns into water and is lost. In a compound the cooling is less, on account of one side cooling only from boiler pressure to receiver pressure, the other side from receiver pressure to atmosphere. This keeps the steam dry. In working engine, if you carry 200 pounds, have that much at all times.

Use full open throttle whenever you can. On level, you cannot, as these engines do not do as well when hooked up. Never have any more water in boiler than you have to, for the steam is damp enough before it reaches the low side. Always cut engine in straight or simple to start

WRECK ON A WESTERN ROAD.

a train, to save drawheads. Also in so doing you get more power as you take away the back pressure on the high side, which amounts to all you get in the receiver when working compound. In freight service these engines have come to stay. Do not work them straight except when almost at a standstill. At speed from 10 to 25 miles per hour these engines do the very best of work. Less than 6 miles per hour they have too much back pressure and are a loss. They have less draft on the fire; therefore coal should be broken and placed in just the right place in firebox. Fire with door open (small Stevens door). Do not be afraid to drop lever down in time when coming to small hard pull. Drop lever before speed is slackened, and they will take a train over that they will stall with if you wait until they slow down before lever is put down. Feed the most oil in high side going up hill or working steam, as it all goes to the low side.

Los Angeles, Cal.

The Hard Railroad Row in Mexico.

When an engineer gets into trouble by means of a collision on a Mexican railroad he is likely to spend months in a prison without trial unless he can escape to a country where justice is rather more discriminating than it is in our sister republic.

E. L. McPherson, who was running a locomotive engine on a Mexican railroad recently found himself under the merciful protection of the United States flag. He relates his experience as follows:

"I left Tampico on the morning of June 26 on engine No. 207, pulling a freight train into Cardenas. I was going up grade nearly all the way, and everything went well until near Cañon le Diable, when I perceived another train tearing down upon me at the rate of forty-five miles an hour. The other train was also a freight. The engineer, who had been on duty about forty-eight hours, had taken out his train under protest. He had instructions to sidetrack at a station within a short distance of Cardenas and let my train pass; but, falling asleep, he passed the station, and was evidently asleep when I first saw him.

"I kept up an incessant whistling for brakes, but received no recognition. When within about 300 yards of the down-grade train I jumped from my engine, although my fireman remained. The trains came together with a crash. The fireman and engineer on the other train and my fireman were instantly killed. As soon as I saw what had happened I struck out afoot and found a few empty boxcars down the road a short distance. I crawled into one of these and locked myself up until night, when the cars were taken to Monterey. There I took a train as soon as possible for Laredo, Tex., arriving there a few days later in safety. The papers reported me among the killed, and the supposition was that I had been precipitated into Devil's Cañon and lost. The reason I was so expeditious in leaving was that had the officers captured me I would have unquestionably been convicted of murder."

A Locomotive Experience Meeting.

BY BULL E. TINBOARD.

One night when there was not much doing, Beach, the call-boy, was sitting on a bench close to me, reading out loud from a book of Kipling's about some engines talking to each other, when old Bill Jones came along, and after listening for a few minutes to the story of the ".007," gave a grunt and said, "Maybe if these old scrapheaps could talk they would tell some tales we would not care to hear," and off he went.

You can bet I chuckled to myself when I heard that, for Kipling's engines are not the only ones that talk to each other.

Pretty soon Beach went away. When we heard him whistling and singing over in the other shed, one of the new Schenectady ten-wheelers gave a short cough and said: "A new man had me out to-day; guess he had never been over this division before by the way he acted. When he got to the place to shut off on top of a hill he kept right on working steam till we were rolling down hill in good style. I like to get a move on a train; it seems more like business. The nicest trip since I came out new was on a delayed passenger train that was tied up by a compound breaking down. I heard the superintendent say to my engineer, 'Now, make the best time you can; this is an important run to-day.' My! How we did roll that train along. It takes a freight man to wheel them when you are in a hurry; some of them don't know just how fast they are going; others are used to going on such short time with a heavy train that when they get hold of a light train with good brakes they just fly. It's some comfort to pull a train fast when you are sure the brakes will hold you. Lots of the full air-brake freight trains don't seem to hold at all nowadays. I am uneasy all the time, for fear we won't get stopped. My pilot has been under a caboose platform once."

Just then one of the old eight-wheel Brooks gave a long sigh that seemed to come from the bottom of his ashpan, saying:

"You would not feel quite so chipper about fast traveling if you had run in the pool as long as I have. There would not be a joint in you that would not work loose and ache. Why, if it was not for the engine inspector chasing around and tightening my loose bolts and putting on jam-nuts, I would have fallen to pieces long ago. When I think of the happy days of my youth, and compare them with the troubles of old age, I don't feel like trying to run at all. When I first came on this road new, old Bill Jones had me regular. He was that jealous of anyone else running me that he never laid off unless I was held in for repairs, and then he would say to the foreman, 'Old man Brooks knew how to build a good engine. You fellows want to fix up that engine just like she was when first built, or there will be trouble!'

"But how this pool business does change a man! Now he don't care a snap how hard he bangs me around. Just acts as if he was taking a run for the hill all the time; and as to oil, why, he just puts on enough to get in with. Sometimes I am so dry it makes me limp and grind for the last few miles."

"Pshaw," says one of the new Baldwin compounds, "you old fogies will have to get used to the new ways of doing things. The pool system is not so bad, after all. You are out on the road more of the time, where you can see things and be doing something. I was made to work, and not to lay idle in a smoky old roundhouse."

"Well," says the little old four-wheel pony, with a scornful tip up of the front step, "from the number of times you compounds get in the shop for repairs, there is not much to brag of. Of course, it is not so bad lately; guess they are catching on to your weak points. Here I have been at it every day and some of the nights for pretty near two years since the last general repairs, and unless the road master kicks up a fuss about my tires being worn down so much, I will be out a year or so longer. Just the same, a good driver brake is the stuff to keep the tires worn down even all over. Ain't it, you old squeezer?" "You bet," replied the driver brake. "Just keep my joints all tight and diamond "S" shoes fast to my heads, and the tires will be trimmed off to the Queen's taste!"

"You fellows all feel pretty chipper," said the fast mail engine, that caught up to a caboose on the main line and was getting the front end patched and the frame ends straightened. "Maybe you think it don't hurt an engine's feelings any to get in a smash-up? I just shivered all over when I saw we were going to strike them. My! What a smash it made! The engineer had me in back and the sand running. I dug my toenails in, but could not get stopped. If the coaches had wanted to get stopped half as bad as I did, we wouldn't have hit them at all!"

"Oh, well," said the little Pittsburgh mogul, "you all have your troubles; but mine would make one of you big fellows crazy. There is a fellow running me that gets pay for being an engineer, who will have me all torn to pieces in a couple of weeks. When he starts out from the coal chute to hook on to the train, he pulls the throttle wide open, and while my drivers are buzzing around, about a pailful of water that was in the steam pas-

sages, and several barrels that flashes out of the boiler, goes through the cylinders. When it fetches up against the cylinder heads, it gives my whole system a shock. Something will break pretty soon. Just wait till the Old Man catches him at it; he'll stop that work."

"Talk about water going through your cylinders giving you a shock," said the local freight engine, "you fellows would kick if you had as much soda ash in your boiler as I have, and then run four weeks without washing out. Why, bean soup is nothing to the mixture in me now. It foams and bubbles over into the steam chest all day long. Most of the time my valves are so dry, they just fairly squawk. As for the piston packing rings, they grind along like a log sled over a railroad crossing.

"When they first began using soda ash, my boiler was washed out clean every Sunday. That worked elegant; but as soon as the scale was all eaten off, they got careless, and now I only get washed out when I get to talking so hoarse with the exhaust that the engineer kicks to the master mechanic.

"They go through the motions of blowing me out every day; but unless someone stands over them with a club, it ain't done half often enough. Slip-shod methods don't go with the soda-ash business. Just wait till we have stalled on the hills a few more times with less than our tonnage, and they will begin to find out that dry steam is handy to have with a full train."

"I hear them talking up a new scheme," said the Richmond consolidation. "It is to give the freight men a premium for pulling more than their tonnage; something like the coal premium and the oil premium, only it works the other way. If they draw more than the regular tonnage, they get extra for it—same as extra mileage is paid now."

This proposition to pay an engineer for working an engine harder than usual threw such a chill on the ideas of all present, that everything was quiet at once. But that won't last long. Engines are something like men—they like to talk about their troubles and kick if things are not arranged to move their way.

Protecting the Locomotive.

In these latter days of the nineteenth century when compressed air, liquid air, Dodge kinetic motors and other things are making life miserable for the poor old locomotive it is pleasing to find a friend, especially one with a patent for a locomotive protector.

The protector consists of a telescoping car, whose interior decorations are a combination of woven wire mattresses and spring beds. This car is mounted on a four-wheel truck, and is designed to be coupled between the locomotive and the cow catcher. Needless to say, it is not likely to be universally adopted in the near future, and while the efforts at protection are appreciated, the crying necessity of a spring bustle on the front of every locomotive has not yet become apparent.

A Bad Explosion.

This locomotive considerately waited until arriving at the end of her run with the train before going up. The baggage had been unloaded and all the cars but the combination were switched off. The brakeman had just stooped to uncouple the air hose when the explosion occurred.

Some of the boiler plate was thrown a thousand feet and buried itself in the ground. Flues were thrown in all directions without regard to cost. The fire door blew open and broke the hostler's leg in six places, so that it had to be amputated. Several other persons suffered injuries, and the bell-ringer was blown through a summer kitchen. The sand box hasn't been found yet.

A CASE OF INTERNAL DISTURBANCE.

Number of Railway Employes.

The number of persons employed by the railways of the United States, as reported on June 30, 1898, was 874,558, which is equivalent to 474 employés per 100 miles of line. As compared with the number of employés for the previous year, there was an increase of 51,082. The number of employés on June 30, 1898, was 956 in excess of the number on June 30, 1893, and 89,524 in excess of the number on June 30, 1895. The employés of railways, as reported to the Commission, are divided into eighteen classes. It thus appears that on June 30, 1898, there were in the employ of the railways 37,939 enginemen, 38,925 firemen, 26,876 conductors and 66,968 other trainmen. There were 47,124 switchmen, flagmen and watchmen. A distribution of employés conforming to the four general subdivisions of operating expenses shows that the services of 32,431 employés were required for general administration, or 18 per 100 miles of line; 261,866 for maintenance of way and structures, or 142 per 100 miles of line; 171,600 for maintenance of equipment, or 93 per 100 miles of line, and 398,907 for conducting transportation, or 216 per 100 miles of line. This statement does not include 9,754 unclassified employés.

The report contains a comparative statement of the average daily compensation of the different classes of employés for the seven years, 1892 to 1898. There is also given in the report a summary which shows the total amount of compensation reported as paid to the railway employés of the country during the four fiscal years ending June 30, 1895 to 1898. This summary shows that the aggregate amount of wages and salaries paid during the year ending June 30, 1898, to more than 99 per cent. of the persons on the pay rolls of railways, was $495,055,618, the increase, as compared with the preceding year, being $29,454,037. This amount of compensation represents 60.52 per cent. of the total operating expenses of railways and 39.69 per cent. of their total gross earnings, or $2,681 per mile of line.—Interstate Commerce Commissioner's Report.

We thought the Holman monstrosity was dead and buried, but it still appears to haunt us. This time it's on a poster advertising the beauties of Sea Isle City, N. J., as a summer resort, and the only wheel visible on the engine is one lone driver over the heads of the crowd. Must be the Holman people hired the artist to keep their memory green.

The Brotherhood of Locomotive Firemen is in a very prosperous condition, for it has closed the twenty-sixth year of its existence with a membership of 30,784, the largest in the history of the organization.

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Murphy's Fast Ride and Sharp Pointed Locomotive.

Bicyclist Murphy rode a mile behind a Long Island Railroad locomotive in 57 seconds. The track on which the bicycle ran was smoothly planked between the rails, and the end of the car was flanged outward at the sides, upward at the top and downward at the bottom to within a few inches of the rails, to shield the rider from atmospheric pressure in front.

Nearly every person has observed the partial vacuum formed at the rear of a fast running train, and its ability to pick up and carry with it for a short distance, scraps of paper, leaves, and even pebbles in its vortex. It was the purpose of this flanged end to increase the partial vacuum ordinarily made, and thereby draw the rider along. Thus it will be seen that as long as the rider kept in the vortex—where there was practically an absence of pressure in front, and atmsopheric pressure behind him—he would be pulled along with little or no expenditure of muscular energy. The rider's task, therefore, was not to propel his machine as fast as the train ran, but was to keep in the vortex and move his feet sufficiently fast to prevent them from impeding the revolution of the pedals. As an athletic achievement, therefore, Mr. Murphy's performance is absolutely valueless, and becomes, instead, a feat of reckless, foolhardy daring, akin to bridge-jumping, should be classed with it as a misdemeanor, and likewise be made punishable.

Had Mr. Murphy, for any reason, failed to keep in the vortex, and been obliged to drop back further behind the train, he would probably have encountered the whirling, eddying currents rushing in to fill up the partial vacuum, and been caused to wabble out of his course and over the rails, which would mean certain death at that speed. This was probably anticipated by the promoters of the event, who stood on the platform and quickly hauled Murphy aboard the train the moment the finish line was crossed.

Murphy's ride has been given undue importance by some of the newspapers, one of which says:

"There is no doubt that in the construction of fast engines of transportation hereafter the problem of minimizing atmospheric resistance by sharp-pointed steel prows in front, or otherwise, will be considered as carefully as is now considered the question of minimizing the resistance of water in constructing the hull of a racing ship."

Although prettily expressed, the quotation shows a lack of knowledge of railway conditions. It assumes that head atmospheric resistance is the obstructing factor to high train speeds, and asserts that such hindrance is as serious a retardation to locomotives as water is to a ship. Confessedly, it is much easier to drive a locomotive through the atmosphere than a ship through water; hence, there is not the same necessity for a pointed front to a locomotive as there is for a sharp prow to a ship.

The Paris, Lyons & Mediterranean Railway of France made very exhaustive trials of pointed prows for the front end of their express locomotives, and great advantages were anticipated in the reduction of head atmospheric resistance; but in practice it was demonstrated that there was no perceptible difference in the air-resistance offered by a pointed cone and a flat smokebox front.

Were the head atmospheric resistance minimized, there remains the wheel flange-against-the-rail resistance, which, when a side or quartering wind blows, becomes a far greater retarding factor than a head atmospheric resistance can possibly be. This is proved by the experience of our prairie railroads; and, conversely, the flange friction on curves is taken advantage of by the calculating engineer to assist in retarding the train with his air brakes when descending mountain grades.

If our lay newspaper friends themselves believe and know no more than that which they write on this subject, they would profit by looking more closely into modern railway operation; for therein will be found a number of greater and more serious drawbacks to very high speeds, which will have to be combatted before we finally revert to head atmospheric resistance, and seek to remove it by designing sky-rocket-shaped locomotives.

Help Engineers to Find Employment.

There is considerable agitation going on at present among the locomotive engineers concerning plans to provide re-employment of engineers who lose their positions on roads where they may have worked for many years until something happened which led to their discharge. The discharging of engineers for violations of discipline by accident or carelessness is not so common as it once was; but there are enough engineers thrown out of employment every month to keep a big army of unemployed men roaming the country in search of work. When an ordinary mechanic loses a job in one shop or town he rarely has to travel far before he finds work, especially if he is a first-class workman. It is different with a locomotive engineer. He may be as good and skillful a mechanic as ever reversed an engine; he may be celebrated among his class for the economical way in which he works his engine and for his thorough knowledge of train mechanism; but these recommendations are of scarcely any service in helping him to secure a new position when once he has been unfortunate enough to lose a job. At every office he calls at in search of employment he receives the stereotyped answer, "We do not hire engineers; we keep up the supply by promoting firemen."

Attempts have been made at various times by the Brotherhood of Locomotive Engineers to secure the co-operation of the Brotherhood of Locomotive Firemen in putting pressure upon railroad companies to hire a certain proportion of the engineers required to keep their list of this class; but nothing is likely to come of it. The subject was discussed at a large union meeting of locomotive engineers, held at New York several months ago, but nothing of any practical value resulted. Now several correspondents of the *Locomotive Engineers' Journal* are agitating the question; but we believe they will fail to obtain any concessions from the firemen.

This, however, does not mean that nothing can be done to help the unfortunate engineer who loses his job to find new employment. Before asking aid and co-operation from the firemen the Brotherhood of Locomotive Engineers ought to organize means for systematically finding out where engineers are wanted and of advising idle men where they are likely to find work. At the union meeting referred to, one of the speakers told about getting into hot water with his officers for hiring Brotherhood engineers exclusively. He did that as a means of

self protection, for he felt certain that when a man applying for employment was a Brotherhood man he had some experience as an engineer, which was by no means certain with men who carried letters of recommendation. A quarrelsome clique of non-Brotherhood men raised an agitation against the man for following the practice described; but the Brotherhood men did nothing to support their brother or defend his practice. They showed themselves perfectly indifferent as to who was hired.

This indifference about the interests of the engineers looking for employment exists to a discreditable extent. The active friends of the order and of the engineer class ought to devote their energies to stirring up the dry bones of apathy which afflicts nearly all divisions. We received application from a master mechanic in Mexico for a few good locomotive engineers a few months ago, and we sent away several sets of men, but they all found work before they reached the Mexican border. If the engineers on the lines where these men found work had any desire to help the men out of employment they would have made the fact known that their officials were looking for engineers. There are several railroad companies which have agreements with their enginemen to hire a certain proportion of the engineers required, but the rule is not observed in any case that we are acquainted with. The apathy of the men on the road is to blame for this.

We advise every engineer who is moved with compassion for the men of his class wandering over the country in search of work, to form himself into a committee of one to find out where engineers are wanted, and to convey the information to those looking for it. He might also profitably agitate in favor of a bureau of information being established by the Brotherhood to find out where men were wanted and the addresses of those looking for positions. That seems to us the most practicable way of helping engineers to find employment.

Court of Appeals Decides in Favor of the New York Air-Brake Co.

The long-looked-for decision in the suit of the Westinghouse Air-Brake Company against the New York Air-Brake Company, for the infringement of two patents of the Westinghouse Company, has been rendered in favor of the New York Company—Judge Lacombe, one of the three Court of Appeals judges, dissenting. The result of this decision is that the New York Company is relieved, for the time being, from any legal obstacle to the continued manufacture of their apparatus. It is a fact, however, that the Westinghouse Company has still two infringement suits pending against the New York Air-Brake Company, one of which includes, under still other patents, the same triple valve that was involved in the suit just decided. The other suit is for infringement in the use of the pressure-retaining valve, which is a device well known to be of the greatest importance to the operation of air brakes upon heavy grades, and on railroads having heavy grades no freight cars would be accepted which were equipped with brakes not provided with it. The situation with reference to the New York air brake is just the same, therefore, that it has been hitherto, except that it has been decided that the New York Company does not infringe under one of the three suits that have been pending against it.

Without doubt, the decision is one of considerable importance to the New York Air-Brake Company, as it permits them to go on with the manufacture of their apparatus, at least until the other two suits of the Westinghouse Company are decided. Had this suit been otherwise decided, the New York Company would have been enjoined from the further manufacture and sale of the apparatus. It is interesting to note that the patent chiefly relied upon by the Westinghouse Company in this suit, is held by the Court to be limited to the class of quick-action air brakes to which the standard Westinghouse apparatus belongs, and it is regarded by the Court as superior to the character of the New York air brake. The inferiority of the New York air brake was, in fact, urged as a strong defense by the counsel for the New York Company, to relieve them from the charge of infringement, and the Court seems to have been readily convinced of the correctness of this view.

It hardly seems probable that this decision will have any great influence upon railroad men. The Westinghouse Air-Brake Company was the one to meet the demands of the railroads for a suitable freight car brake when, in 1886, it was found that no acceptable brake had yet been devised for such use. It was never claimed that the New York brake is superior to, or even the equal of, the Westinghouse, nor that the New York Air-Brake Company has done anything to improve the art of train braking, or to accomplish greater security to railroad transportation. The earlier forms of the New York air brake were mere imitations of the Westinghouse apparatus, the manufacture and sale of which were enjoined by the Courts. The present form of New York brake was devised, as admitted by that company, in defending itself in this suit, upon inferior lines, in order to avoid the charge of infringement upon the patent rights that cover the Westinghouse standard apparatus.

There are now in use about 850,000 freight-car brakes that have been furnished by the Westinghouse Air-Brake Company, and only about 300,000 freight cars yet exist, the value of which is sufficient to warrant the application of freight-car brakes. The difficulties that have attended the repair and maintenance of the diverse forms of so simple a contrivance as the automatic coupler, have led many thoughtful railroad officers to maintain a stubborn resistance to a multiplication of air-brake standards, the largely increased number of parts of which, in comparison with automatic couplers, would entail a vast complication of repair material and difficulty of maintenance. Leaving aside, therefore, the interest which this litigation has for the respective brake companies, it does not appear that the recent decision has any particular bearing upon the future action of individual railroads. The question whether the Master Car Builders' Association is going to modify its requirements of an acceptable freight-car brake, to include a type that was not considered worthy of acceptance when the requirements were formulated, is still to be decided. Until this question is decided, no material change is to be expected in the views of those who have heretofore adhered to what is acknowledged to be the best, and what has become so nearly the universal standard in making an investment of such a permanent character as that of the purchase of air brakes.

Something for Nothing.

The old axiom, "You can't get something for nothing," has been repeated until it would seem to be worn out, and yet it will continue to be appropriate as long as would-be inventors endeavor to enlist capital in wonderful machines that create power.

If you should go to an insurance man and propose a scheme for insuring persons in poor health at the standard rates, and attempt to prove by manipulated figures that it would pay 50 per cent. profit, he would laugh at your plan, tell you it could not be done, and probably would not even examine into it. He knows the laws of insurance as we know the laws of mechanics, and will not waste time on an absurdity.

But go to him with a perpetual-motion device, a rotary engine, a liquid-air scheme, or any of the many power creators and he may take any bait offered. He understands insurance, but knows nothing of mechanics; consequently, if a machine will go, it must be a great scheme, and all the inventor's claims realized. He does not realize that it's a mighty poor engine that won't go with steam behind it. He sees through the something-for-nothing scheme in business he is familiar with, but when he gets outside of that he is an easy victim.

Just at this time there are a dozen stock schemes afloat which promise great results, such as running air ships from New York to Paris in 1900, making the trip in thirty hours. Then there is the liquid-air scheme for doing everything from freez-

ing ice-cream to running every engine on earth. The multiple-power scheme, which is simply a gearing-up device performing exactly the same work as spur gears, but with ten times the machinery, bearings, connecting rods, arms, rolls and dufangles generally. This saves on 66⅔ per cent. By using another one on the same engine, you would have power to sell.

Every one of these schemes are attempts to get "something for nothing" in one way or another. Every machine that was ever built, or that ever will be built, gives out less power than it receives. How much less, depends on the number of joints bearings and other ingenious devices the inventor has put into it; the fewer of these, the less the frictional loss. And when anyone, with or without authority, title or backing of any kind, claims to get 10 gallons, or horse-power, or anything else, from 3 units of the same kind, it is useless to even argue the case with him. He is either foolish himself or thinks you are.

These plans and stock companies would be laughable if it were not for the effect on legitimate enterprises. But men who are bitten on these wild schemes fight shy of industrial investments that are really good, and which could give a fair return for money invested, besides giving employment to many mechanics.

For this reason, if for no other, it is to the interest of all mechanics and mechanical papers to expose the schemes as fast as they are presented. Beware of the man who promises too much from any device; and if he talks about creating power or using it over again, it is better to have business elsewhere.

Inferior Soft Steel Castings.

Great advances have been made in the last ten years in the art of pouring soft steel castings to insure solidity and freedom from blow holes. In a statement made about the failure of Master Car Builders' car couplers, made by Mr. J. W. Thomas, general manager of the Nashville, Chattanooga & St. Louis, published in another part of this paper, he says that scores of steel knuckles have been found so full of blow holes that they would not withstand the shocks of hard service. This is an old complaint about soft steel castings, but it does not apply to the product of firms that know how to make good steel castings. It applies merely to those castings made to sell at the lowest possible figure, cheap articles made without skill or knowledge of how a good casting ought to be made. A few years ago much indignation was excited in railroad circles by the information that certain railroad companies were making knuckles of cast iron to replace those broken on foreign cars, and the indignation excited by this dishonest practice was entirely justifiable. But to-day some concerns are turning out what they call steel knuckles that are no more reliable in service than the cast-iron knuckles whose manufacture was repudiated as palpable fraud.

It is a melancholy fact that years and years of experience that proved that the cheapest article in first cost has failed to convince railroad companies or their purchasers that a good article could only be bought by paying a fair price. In too many instances the purchasing agent accepts the cheapest article, regardless of quality, and the road pays dearly in the end for the articles that are not capable of withstanding the proving ordeal of train service. The sentiment is growing, to require all articles purchased for railroad machinery to pass successfully through certain physical tests, but its progress is too slow for the best interests of railroad companies.

There are many firms in the United States that can make steel castings that are as reliable and sound, in small articles like a car-coupler knuckle as the best forging ever turned out, and all that is necessary to purchase such castings is to pay a fair price for them. Those who purchase steel castings full of blow holes are merely engaged in a business of cheating their interchange connections.

In connection with the progress in producing perfectly sound steel castings, a recent discovery, made by British metallurgical engineers, is of some interest to Americans engaged in this line of business. It seems to have been demonstrated in Great Britain that the ability to produce perfect steel by casting it in a vacuum made by liquid hydrogen with a process that it is not proposed to make public, has at last attained practicability. A company has been formed with a capital of £30,000 to experimentally develop the process, and if the plan is as successful as Prof. Dewar, the discoverer, presumes it will be, the air bubbles that now cause flaws and weakness in steel will be done away with and a metal will result such as the world has never seen. To say that this means a possible revolution in the steel trade is to put it mildly, and if the English government can control the process, as it is now intimated may be the case, then American scientists and those of other countries will be put upon their mettle to get even with the Britishers.

Favor the Use of Spectacles.

The article entitled "Shall Engineers Wear Spectacles?" published in the July number of LOCOMOTIVE ENGINEERING, appears to have excited much attention among all classes of railroad men. We have received several letters commending the humanitarian utterances of the article, and many people have commended it verbally. One correspondent says: "It is just what men of our age need on locomotives. Like the Lord's Prayer, it should be universally scattered. I should like it to be issued as a leaflet and circulated broadcast."

In the course of a private letter to the editor, a high-up railroad official says, among other pleasant things: "I want to commend your attempt to prolong the useful life of an engineer by allowing such legitimate assistance as spectacles afford. Within reasonable limits, I think it should be true that engineers improve with experience, like the balance of humanity. It certainly seems as if a man who had been through trying circumstances without losing presence of mind, and learning to so control himself that he does not, on discovery of an obstruction, reverse an engine fitted with driver brakes, but deliberately does his best to stop the train, is a safer all-round man to trust with a passenger train than a younger man with less experience, and seeing no farther with the naked eye than the veteran can with the assistance of glasses.

In another column is a communication from an oculist who has had years of experience in testing and aiding the vision of engineers. His opinion confirms ours, that all proper aids to clear and distinct vision should be used. His statement of the case is clear. One good point made is that an extra pair of glasses should be carried for use in case of the regular pair being disabled.

Do You Want a Push Over the Hill.

Engineers and firemen know that with a good steaming engine, favorable conditions of rail and weather, a train of moderate weight gives them no uneasy thoughts of stalling on the hard pulls.

But when the full capactiy of the engine is required regularly for a hard grade when you start out of the yard it is different, and if a few of the cars are heavier than ordinary and pull hard, help from one of the switch engines is necessary. Now let us compare the work of the engine with the mental work required of the engineer and fireman.

The time was, years ago, when the engines were smaller than at present and not loaded to so near their full capacity, that they were not worked so hard as at present, and the mental work was of the same character. But with the advent of larger engines and more attachments and details like the air brake, lubricators, compound features and other contrivances which add to the mental work of the men on the engine, the load on the man has increased.

Our view of it is that as the mental load increases the grade of the men has also increased in a wonderful measure. Still a little help comes handy.

Now when you are loaded a little heavier with extra calls for skill and education in the shape of air-brake knowledge, examinations, etc., it is like the extra car you pull on your train. A pusher helps with the train of cars, so a

pusher will help with the train of knowledge, and LOCOMOTIVE ENGINEERING aims to be that pusher and help you. We will push you regularly twelve times a year, and if you need any special help in either air-brake or mechanical matters our "Question and Answer" columns are open to you at any time.

Cheap Car Couplers.

It is curious, but it is true, that many railroad officials will resort to sharp practices for the companies they serve which they would consider dishonest if carried out in their own private business. This is particularly conspicuous in the dealings between companies interchanging cars, and the endless effort of one road to get the best of the other. Some of the practices followed are downright cheating. At present the greatest iniquities seem to be perpetrated in connection with the Master Car Builder type of coupler. According to the Interchange of Cars Rules, any railroad company can replace a broken coupler with any coupler of the standard type. A good coupler of that kind costs about $8, and is quoted in the Master Car Builders' rules at $7.50. It may be regarded as certain that car couplers costing much less than the figures quoted are too inferior to hold cars together safely. Yet it is well known that different railroad companies are in the habit of buying couplers that cost only about half the price named, and that these cheap and dangerous articles are kept to be put on foreign cars when a good coupler breaks. The railroad company which has been imposed upon in this shameless manner has no redress, and there is good reason for believing that some of them have resorted to retaliation in kind. Some railroad companies at one time got into the habit of making cast-iron knuckles to use in the repair of foreign cars, but the practice was so loudly denounced that it was stopped. The indignation aroused by that piece of sharp practice ought to be fanned into active heat against the cheap coupler.

Encouraging Self Help.

We receive periodically communications dwelling on the duties of railroad officials towards the young men who enter the service entirely ignorant of the duties they will be called upon to perform. A particularly verbose letter of this character recently received, made out that it was the duty of railroad officials or philanthropists to put in operation some kind of kindergarten instructions of advanced ideas to teach young mechanics and young trainmen the scientific principles underlying the work they are called upon to perform. It was presumed to be the duty of someone to coddle every aspirant of a railroad career into making the science of his business a study for hours of leisure.

We believe in providing means for ambitious men to improve their education, but there is a tendency to require too little effort from the individual to be benefited by instruction. Men with the right ideas of life do not wait to be coddled and encouraged into doing something for themselves. They soon realize their educational shortcomings and proceed steadily and industriously to overcome them. These are the kind of men who fill the majority of official positions to-day, and it is the same class of sturdy self-helpers who will succeed the officials now in harness. Those who are not imbued with the self-denying qualities that impel a man to work and study while others are playing, deserve to remain in the ranks till their working life is finished.

Instruct the Car Repairer.

There was one curious discussion at the Master Mechanics' convention. For the noon-hour topical discussion the second subject was: "Has not the time arrived when air-brake instructors can accomplish more by instructing those who maintain brakes how to maintain them, than to instruct those who use them how to use them?"

There is no question that the time has arrived for instructing the men who maintain brakes, for that end of the business has been badly neglected; but that is no reason why there should be any less attention bestowed upon the men who handle the brakes. It is difficult to think of any railroad expenditure that brought back such good returns as the money spent on instructing train men how to handle the air brake properly. Much loss and damage to rolling stock have come to railroad companies from the prevailing neglect of the car repairer, who is treated as if knowledge of triple valves, air cylinders, etc., would come to him by inspiration.

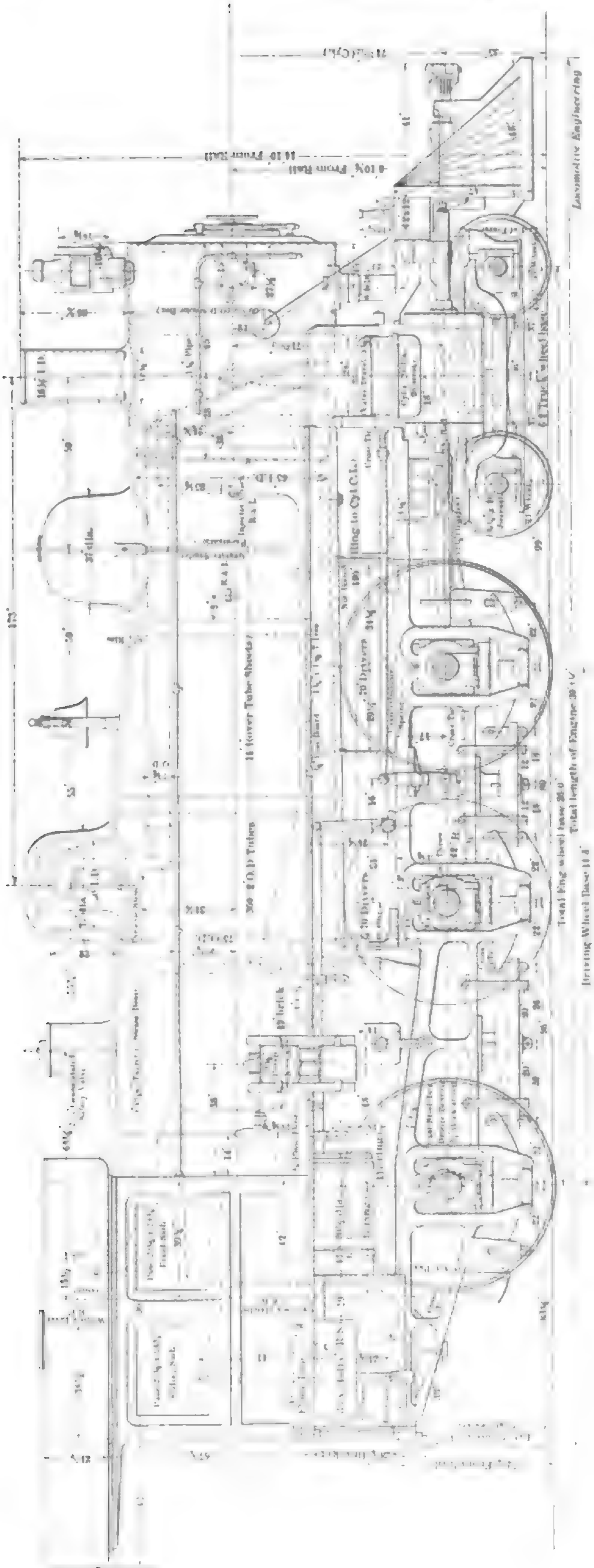
Science in Steel Making.

It was estimated fifteen years ago that the annual world average of the consumption of iron and steel was 32.33 pounds per head. At that time the people of Great Britain were consuming 287.53 pounds per head every year, those of the United States 270.92 pounds, the inhabitants of South America only 13.5 pounds, while in Egypt the amount fell to 7.55 pounds, in British India to 2.4 pounds, and in the remainder of Asia to less than half a pound. The lowest average for any European country was 23 pounds per head. It was said at the annual meeting of the British Iron and Steel Institute, early this year, that the consumption per capita in Great Britain had somewhat increased and was probably about 300 pounds. Satisfactory statistics as to the present consumption per capita in the United States are not available, as nine years have elapsed since our census was taken; but with the large increase in our use of iron in shipbuilding, water and gas pipes, telegraph wires, wire fences and ropes or cables, and the development of our great machinery and tin plate industries, it is probable that we have at least kept pace with Great Britain in the utilization of iron and its products, even if we have made little advance upon our earlier consumption for railroads and their equipment. In total consumption we surpass all other countries. The United States and Great Britain are far in the lead, chiefly because they use so much iron and steel in railroads and their appliances, machinery and shipbuilding.

We hear now of blast furnaces that produce 700 tons of iron a day, of open-hearth furnaces fed with a ton of material a minute, of enormous mixers that hold 200 tons of pig iron, of rolled steel plate 2 inches thick and over 300 square feet in area, of steel plates that buckled up in a collision but remained watertight, and of girders justifying the belief that bridges may yet be built, if desired, in half-mile spans. All these wonders are the achievements that scientific workers have made possible by years of research and experiment in the comparative quiet of the laboratory. The study of alloys, of the plasticity and other properties of steel, of the use of electricity in riveting hardened ship plates that otherwise could not be drilled, and many other complex problems has resulted in brilliant triumphs for the chemist and physicist. Germany did not take a high place among steel producers until the invention, in the seventies, of a process by which phosphorus pig iron might successfully be used in steel making.

There were some strikes among the street-car employés in the neighborhood of New York last month, and rumors of a great many others that did not materialize. It seems to us that the sensational stripe of newspaper known as "yellow journals" has been responsible for considerable discord between employers and workmen. These yellow sheets thrive on agitation and sensation, and they do their utmost to promote strife. Their agents and emissaries have been laboring hard to foment strife between the trainmen and the officials of several steam railroads running into New York, but fortunately they have not succeeded in doing much harm, although they have created considerable uneasiness on several railroads.

A correspondent writes us that the Cincinnati, Hamilton & Dayton Railroad have introduced the smokeless system of firing. Mr. F. O. Miller, engine inspector, is teaching the enginemen how to do the work, and they are falling in line quite cheerfully. After getting the hold of the new method the firemen acknowledge that their work is lighter than it was under the old load-up practice.



NEW YORK CENTRAL'S PASSENGER TEN-WHEELER.

New York Central's Passenger Ten Wheeler.

The handsome ten-wheel passenger engine illustrated by half-tone cut and two line engravings is the latest machine put into service by the New York Central for the purpose of handling the heavy fast passenger trains, so many of which are run by this company. The engine was designed by Mr. William Buchanan, and was the most important work done by him before he retired from the service of the company. The conspicuous features of the engine are great heating surface and strong tractive power, two features that harmonize to produce an efficient engine for high speed and heavy trains.

Looking at the half-tone picture without any object of comparison for judging dimensions, the engine does not look unusually large; but when we examine the dimensions on the line cuts, we find that the cylinders are 20 x 28 inches, that the driving wheels are 70 inches diameter, that the boiler is 66 5-16 inches diameter at smallest ring and provides 2,886.16 square feet of heating surface. The area of grate is 30.32 square feet.

The tractive power in starting, as worked out by the usual formula, is 27,200 pounds, and the ratio of power to adhesion is about 4.

Another admirable feature about the engine is the liberal bearing surfaces. The driving axle journals are 9 x 12 inches, the main crank pin journals 6 x 6 inches, the main side rod journal 6¾ x 5¼ inches, and the front and back side rod journals 5 x 3¾ inches. These rods have been finished so accurately that one side could be placed upon the other and plugs 1-100 inch smaller than the holes dropped into all the crank-pin holes. The engine truck journals are 6¼ x 10 inches.

The line engraving gives such full details of the engine that few more particulars are necessary. As will be noticed, the top of smokestack is 14 feet 10 inches above the rail. The total wheel-base is 26 feet, of which 14 feet 8 inches are rigid. The piston, 4½ and 5 inches horizontal thickness, and the packing consists of three cast-iron rings. The length of ports is 18 inches, and the width of steam port is 1¼ inches, while the exhaust port is 2¾ inches wide. The valves are American balanced, with 5½ inches travel, having 1 inch outside lap and set without lead.

The driving-wheel centers are of cast steel, and the driving boxes are of the same material. The engine-truck wheels are Krupp steel tired, 33 inches diameter.

The boiler and firebox are made of carbon steel of varied thickness to suit the strains imparted. There are 360 tubes, 2 inches diameter and 14 feet 4 inches long.

United States packing is used for piston rod and valve stem glands. Monitor injectors are used to supply the water, and three 3-inch consolidation safety valves are provided to take off the excess steam

pressure. Westinghouse-American brake is on drivers, and the shoes are drawn to hind part of the tires to prevent the jerk in stopping common to the brakes of driving wheels applied to the front of the tires. Brakes have also been applied to the engine-truck wheels. A 9½-inch air pump is provided to give an ample supply of air pressure.

Railway Accidents.

The total number of casualties to persons on account of railway accidents during the year ending June 30, 1898, was 47,741. The aggregate number of persons killed as a result of railway accidents during the year was 6,859, and the number injured was 40,882. Of railway employés, 1,958 were killed and 31,761 were injured during the year covered by this report. With respect to the three general classes of employés, these casualties were divided as follows: Trainmen, 1,141 killed, 15,645 injured; switchmen, flagmen and watchmen, 242 killed, 2,677 injured; other employés, 575 killed, 13,439 injured. The casualties to employés resulting from coupling and uncoupling cars were, persons killed, 279; injured, 6,988. The corresponding figures for the preceding year were, killed, 214; injured, 6,283.

The casualties from coupling and uncoupling cars are assigned as follows: Trainmen, killed, 182, injured, 5,290; switchmen, flagmen and watchmen, killed, 90, injured, 1,486; other employés, killed, 7, injured, 212. The casualties resulting from falling from trains and engines are assigned as follows: Trainmen, killed, 356, injured, 2,979; switchmen, flagmen and watchmen, killed, 50, injured, 359; other employés, killed, 67, injured, 521. The casualties to the same three groups of employés caused by collisions and derailments were as follows: Trainmen, killed, 262, injured, 1,367; switchmen, flagmen and watchmen, killed, 13, injured, 69; other employés, killed, 38, injured, 367.

The number of passengers killed during the year was 221 and the number injured was 2,945. Corresponding figures for the previous year were 222 killed and 2,795 injured. In consequence of collisions and derailments 72 passengers were killed and 1,134 passengers were injured during the year embraced by this report. The total number of persons, other than employés and passengers, killed was 4,680; injured, 6,176. These figures include casualties to persons classed as trespassers, of whom 4,063 were killed and 4,749 were injured. The summaries containing the ratio of casualties show that 1 out of every 447 employés was killed and 1 out of every 28 employés was injured. With reference to trainmen—including in the term enginemen, firemen, conductors and other trainmen—it is shown that 1 was killed for every 150 employed and 1 was injured for every 11 employed. One passenger was killed for every 2,267,270 carried and 1 injured for every 170,141 carried. Ratios based upon the number of miles traveled, however, show that 60,-542,670 passenger-miles were accomplished for each passenger killed, and 4,543,270 passenger-miles accomplished for each passenger injured.—Interstate Commerce Commissioner's Report.

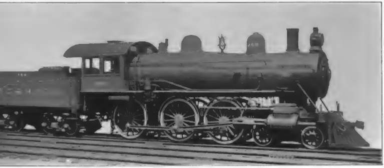
New Delaware, Lackawanna & Western Engine.

Superintendent of Motive Power and Machinery John W. Fitz Gibbon, of the Delaware, Lackawanna & Western Railroad, has about finished, at the Scranton shop, a very large locomotive, consolidation type, having four pairs of drivers, 57 inches outside the tires, all of which are flanged. The weight on drivers is 172,000 pounds. The engine will have a tractive force of 44,000 pounds. The cylinders are 22 x 30 inches. The shell of the boiler is of ⅞-inch steel, 74 inches internal diameter, carrying a working pressure of 200 pounds. The firebox is 10 feet 6 inches long and 9 feet wide—probably as large a firebox as has ever been built for a locomotive. The boiler contains 413 2-inch flues. The total heating surface is 3,010 square feet. Some of the clearance dimensions are: Height of boiler above rail, 12 feet 1 inch; engine, over all, 15 feet high; the cab is 10 feet 4 inches wide. The loaded weight of this engine is 200,000 pounds. The tender holds 5,000 gallons of water, and a proportionate large supply of coal.

The proportions of this engine are very neat. She is intended for heavy freight service. Of this work we will speak later, when the engine is in regular service.

A committee of the Traveling Engineers' Association has been appointed to report at next convention on "How can the responsible engineer be located when an engine has been subjected to unfair usage under the chain gang or pooling system?" The committee seems to be doing the work of investigation very thoroughly, for a circular containing eight questions has been sent out, and ought to bring a great deal of useful information. If the inquiries of the committee are widely answered the committee may be able to make a report that will tend to bring about some uniformity in the practice of holding the right man responsible for neglect of engines. Mr. W. G. Wallace, Baraboo, Wis., is chairman of the committee, and A. B. Collins, A. L. Fuller, E. W. Brown, P. H. Stack are his associates.

We learn that the Falls Hollow Staybolt Company, Cuyahoga Falls, Ohio, are rushed on the manufacture of safety hollow staybolts, made both of charcoal iron and steel, for locomotives and marine boilers. They have recently received a very large order from Harlan & Hollingsworth Ship Building Company, and are working into a very good marine business.



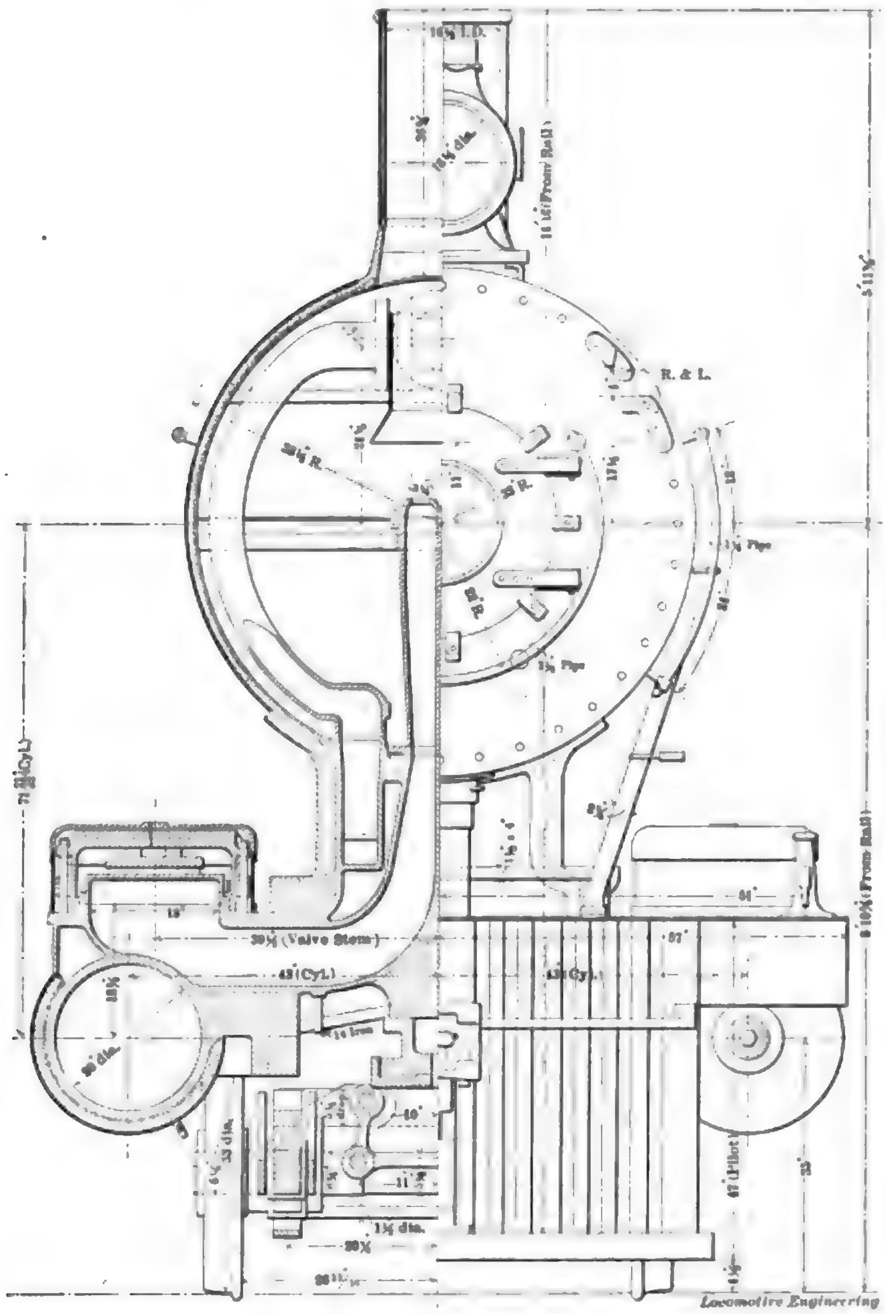
NEW YORK CENTRAL'S PASSENGER TEN-WHEELER.

Big Steel Order.

If a recent dispatch from Pittsburgh is correct, the leading builders of steel cars seem to anticipate continued big orders for their cars. The dispatch says:

"Announcement is made of a contract between the Carnegie Steel Company, Limited, and the Schoen Pressed Steel Car Company, of this city, to run for ten years. During that time the Carnegie Company is to furnish the car company with 1,000 tons of steel plate daily, amounting to over $6,000,000 a year. This is said to be one of the largest single contracts ever made in this country, and it is the result of an agreement between the Carnegie Company and the Pressed Steel Car Company for the former to keep out of a field occupied by the latter.

"It was reported some time ago that the Carnegies would make steel cars, but now they have finished a plant that will turn out the requisite amount of plates for the Schoens. The first consignment will be delivered on August 10th.



NEW YORK CENTRAL'S PASSENGER TEN-WHEELER.

A particularly artistic and imposing-looking illustrated catalogue has been issued by the Gold System of Car Heating, showing up the whole of the system and its details. It is illustrated by very fine engravings, and the text is so clearly set forth that no one interested in a car-heating device will fail to understand the information given. We believe that persons connected in any way with car service can obtain a copy of the catalogue on application to the Gold Car Heating Company, New York.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(79) E. W., Scranton, Pa., writes:

Suppose we have an engine with 24-inch stroke, main rod 9 feet long, and start the engine from the back center and run her ahead to the forward center. Now, what I want to know is, is there any difference in the piston travel from back center to quarter and from quarter to forward center? A.—The piston will travel farther when the crank pin is moving from the quarter to the forward center. The inequality is known as the angularity of the main rod. The angularity will be greater with a shorter than with a longer one.

(80) L. C., Norfolk, asks:

Will the boiler of a Vauclain compound, having cylinders 13 and 22 inches, supply steam enough for a simple engine with 18 or 19-inch cylinders? A.—At the same pressure, say, 180 pounds, a 13 and 22-inch compound is considered equal to an 18-inch simple engine, as far as power is concerned. The compound, however, will use less steam than the simple in doing the same work; so that if the boiler is just big enough for the compound it will not supply the 18-inch simple engine doing the same work.

(81) "Mac," Buffalo, N. Y., writes:

1. Does an eccentric with a 6-inch throw have as much travel as a 6-inch crank? A.—1. Yes. 2. Is the vacuum line we read about in mechanical books real as a basis to work from? A.—2. Yes. 3. Is the atmospheric line the resistance that exhaust steam meets with or equalizes to? A.—3. The atmospheric line represents the pressure of the air, and is 14.7 pounds above vacuum. 4. What is the proper way to measure the throw of an eccentric? A.—4. Measure from center of driving shaft opening to the longest point of eccentric, then to the shortest point. Deduct the shortest from the longest, and that will give the throw of the eccentric.

(82) J. F. W. asks:

If making an air-tight connection with the overflow nozzle and waste pipe to a non-lifting injector, will the injector prime as well? I contend it will, and better or quicker, and the only disadvantage of having it air-tight is that the water will siphon out of tank through the injector at times. Another party claims the injector will not prime at all with air-tight connection. Who is right? A.—If the connection is air-tight at the overflow and the bottom of the overflow pipe is lower than the tank, it can, as you say, siphon out the water from tank. An "air jet" that would draw a sufficient quantity of water through the combining tube of an injector to condense enough of the steam going through steam tube to hold water up to injector,

would make a lifting injector of it. An air jet will not draw and force the same amount of water through the same size hole as steam of equal pressure.

(83) P. K., Randwick, New South Wales, says:

I am driving a Baldwin motor; the cylinders are 11 x 16-inch stroke, drivers 3 feet 6 inches diameter. Will you kindly inform me how many horse-power she is, also what would be the greatest speed such an engine could attain under the most favorable conditions? A.—You have left out the most important particulars in figuring the horse-power of an engine, viz., the mean effective pressure on the piston and the piston speed in feet per minute. The power of a locomotive is usually calculated to show the tractive force at the drawbar by this method: Square the diameter of the cylinders; multiply this by the stroke; divide the product by the diameter of the wheel, all taken in inches. Multiply this quotient by 85 per cent. of the boiler pressure. This gives the tractive force. The only way to get the horse-power of a locomotive engine exact is to use an indicator and calculate the power from the card, as the conditions of cut-off, expansion and compression, cut quite a figure in the power realized. As to the speed, that depends on the steam distribution. I have ridden on a 42-inch consolidated Baldwin narrow-gage engine drawing a train at fifty-two miles an hour, and the engine could have made better time.

A committee of the Traveling Engineers' Association, of which Mr. C. H. Stalker, Colingwood, Ohio, is chairman, has been appointed to report on "Long Runs of Locomotives, With a View of Economical Treatment and Maintenance From the Traveling Engineer's Standpoint." Ten questions will be sent out to be answered, and they seem to cover the subject pretty thoroughly. We are very much interested in this subject, and should like very much for everyone to whom a circular is sent to answer the questions. From our correspondence standpoint, there are so many conflicting views about the real value of the pooling system and the system of long through trains that we should like to obtain the views of those best prepared to write or talk authoritatively on the subject.

The National Railroad Master Blacksmiths' Association will convene in convention at Milwaukee, Wis., on September 5th, at the Plankinton Hotel. This is a very useful association and ought to obtain the countenance and support of all railroad officers. We hope our blacksmith friends will have a very successful meeting and assimilate a great deal of useful information respecting their art.

Smokeless Firing With Bituminous Coal on Passenger Trains.

BY W. J. MURPHY.

HOW IT IS DONE ON THE QUEEN & CRESCENT (C. N. O. & T. P. RY.)

There is no detail in connection with the operation of this line outside of the necessary precautions for safety to which the management gives so much special and continued attention as in efforts to prevent the emission of black smoke by locomotives on passenger trains, which is the cause of so much discomfort to passengers.

As to the results of the methods employed, the accompanying illustrations show what has been accomplished. The photograph shown represents the "Queen & Crescent Limited" with five cars running up a 52-foot grade at a speed of 61 miles per hour, as indicated by the speed recorder on the engine. It will be noted especially the absence of the objectionable black smoke.

QUEEN & CRESCENT LIMITED, RUNNING 61 MILES AN HOUR ON GRADE 52 FEET TO THE MILE.

To secure these results it was necessary, first, to equip the engines with brick arches, as indicated in the cut herewith. Four holes are shown on each side of the firebox for the purpose of admitting air. Four tubes run through the arch, and the outside air, passing through these tubes, is heated to a high temperature. This heated air supplies oxygen to the unconsumed gases and produces complete combustion. The four holes in each side of the firebox are located 12 inches above the grates, and into these openings are inserted the Sharp patent deflecting air tubes, deflecting the air into the fire. Second, to thoroughly educate the enginemen and firemen in the methods necessary to produce the desired results, and to this end the following instructions were issued:

INSTRUCTIONS FOR FIRING PASSENGER LOCOMOTIVES ON THE QUEEN & CRESCENT. TO PREVENT SMOKE.

Explanatory.

Bituminous coal contains a large percentage of hydrocarbons, which are nearly all driven off as gas by the heat of the furnace, in a few seconds after the coal enters the firebox.

Hydrocarbons, when unconsumed, make objectionable black smoke, but when a sufficient quantity of air is mixed with the hydrocarbons combustion is complete and no smoke appears.

Passenger locomotives have been provided with hollow fire-brick arches and deflecting air tubes to deflect the gases and to supply the necessary air to make perfect combustion.

Rules.

After firing each shovelful of coal the door must be left open one or two inches for a few seconds, admitting enough air to produce complete combustion of the gases driven off from the coal. Care must be taken not to leave the door open longer than necessary to consume the gases.

Firemen must learn to work with as light a fire as possible. Great care must be taken that steam is not wasted at the safety valve, either when the train is in motion or when standing still.

Before starting, the blower must be put on and a sufficient supply of coal put into the firebox to insure a good solid fire. After the coal has been put in, the door must be left partly open by placing the latch on the first notch of the catch, to so remain until the smoke entirely disappears, when the door must be closed.

After starting, the door must be left partly open after each shovelful of coal is put into the firebox, by placing the latch on the first notch of the catch until such time as the smoke disappears, when the door must be closed.

On approaching tunnels the fire must be replenished in ample time, obtaining sufficient fire to carry the train through the tunnel without smoke; the door to be kept closed while passing through tunnels.

The engineman should so arrange the water supply that the fireman may be able to fire the engine regularly and economi-

cally, and this can be done best when the water is supplied to the boiler continuously.

Firemen must pay particular attention to the manner in which the engineman works the injector and handles the engine, in order to regulate the fire accordingly.

Care must be taken to have the blower applied and the door partly open when approaching a station where stop is to be made, and no smoke must be allowed to show from the stack at such times or when descending grades.

While the blower is being used, except when approaching a station where stop is to be made, care should be taken to keep the door closed as much as possible, more especially when cleaning the fire, as the blower causes the cold air to be drawn into the flues.

While lying on side tracks, both dampers should be closed to save the fire.

Grates should be shaken only when absolutely necessary, as too frequent shaking causes a loss of fuel by allowing the unconsumed coal to fall into the ash-pan, where it ignites and causes the pan to heat and warp. All ash-pans should be examined as frequently as stops will permit, and under no circumstances must they be allowed to become filled.

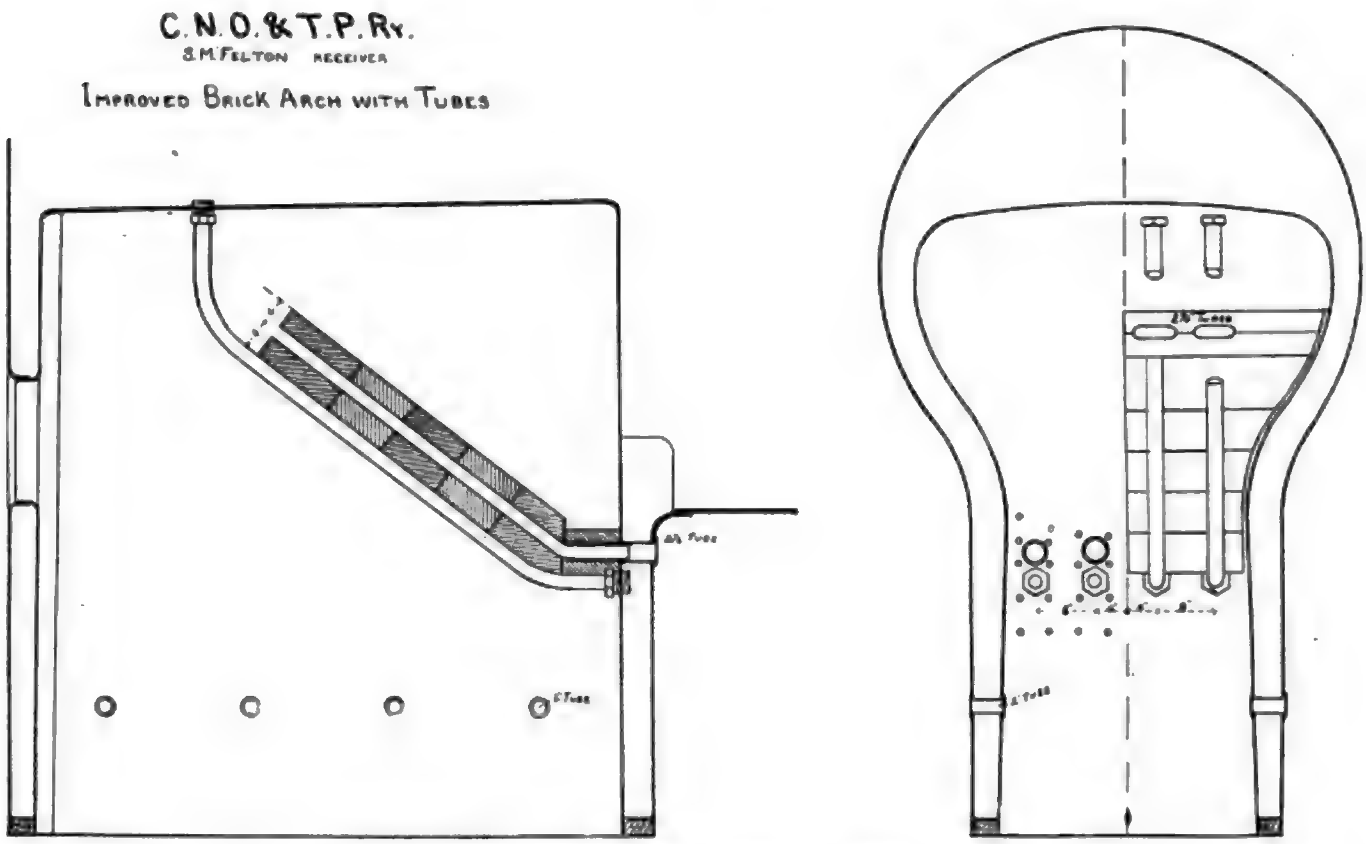
When possible to avoid it, the fire-door must not be left wide open. To leave the fire-door wide open is especially bad when using steam or blower.

It is beneficial to wet the coal before firing, and firemen should, as far as possible, use wet coal.

Intelligent firing and economical results in the use of fuel will be considered in the selection of firemen for passenger engines or for promotion to freight enginemen.

These rules must be strictly observed on night as well as day passenger trains.

In addition to the training, the most persistent vigilance on the part of the management was necessary to secure continuous good results, as it developed in this case, as in others, that it became, in time, an old story; some of the men grew careless and dropped back to the good old-fashioned way of firing, half a dozen shovels of coal without intermission. For the purpose of keeping a close check on all passenger engines, small report blanks (sample herewith) were distributed to all officers of the road, which included general passenger and general freight agents, road master, track supervisors, signalmen, etc., and it is their duty, when they observe smoke on passenger trains, to report the matter by filling out the blank and forwarding it to the superintendent, who promptly investigates, taking such action as will correct the matter; if it be poor coal, as has developed in most instances, a better quality is supplied; if it be careless firing, the party responsible is disciplined.



SMOKE PREVENTING DEVICE, QUEEN & CRESCENT.

The Standard Paint Company, New York, ought to be able to sell great quantities of their ruberoid covering to railroads in the South. We noticed during a recent tour that many of the engine houses and other buildings are covered with metallic substances and that they are nearly always in a dilapidated condition. The moist atmosphere quickly corrodes metals and leaves the roof worse than it is when entirely open. The ruberoid referred to has a base of wool and hair felt and is combined by an acid-proof composition, which makes a very compact board that successfully resists the sulphurous fumes so common in railroad buildings. It also makes an excellent covering for engine cabs. Being an indifferent conductor of heat, it tends to make a cool cab.

The *Patent Record* is the name of a very handsome illustrated journal of thirty-two pages, published in Baltimore in the interests of inventors and persons engaged in the patent business. Nearly every page has one or more illustrations, some of them extremely fine. The first page is occupied by a large picture of the Mount Royal Pumping Station, on North avenue, Baltimore, which is an excellent piece of work, and ten other pictures illustrate various features of this handsome public building. There are other articles equally good.

Illinois Central Shops at McComb City, Miss.

At McComb City, Miss., there is a fine plant of repair shops, belonging to the Illinois Central, which are maintained in excellent order by the master mechanic, Mr. L. L. Dawson, who seems to have the bump of order particularly well developed in his head. They do a great deal of work here without particularly fine facilities, but those in charge seem to know about the maximum of how to make the best of it.

They have a very good foundry where castings are made for all the southern part of the Illinois Central System, and remarkably good castings they make. I noticed in the foundry that Mr. Dawson had taken a suggestion from LOCOMOTIVE ENGINEERING and converted an old air-brake pump into an engine for hauling up scrap from the ground to the top of the cupola. It works very well indeed, practically costs only the work of changing it, and does away with the work of five or six men. Mr. Dawson pays a great deal of attention to his scrap heap, and keeps a man there all the time selecting the different material. An intelligent man doing this work saves for use a great deal of material that otherwise would have to go to the forge and cupola, and it seemed to me one of the best paying investments I have seen about a shop.

The company are applying Monarch brake beams to all their cars, and those in charge speak very highly about the efficiency of this beam. They are also putting a great many Westinghouse air brakes on freight cars.

An industry that calls for a great deal of work here is the making of false bottoms for fruit cars. This consists of a grating made of wood, which enables the air to circulate beneath the load, and is said to be particularly efficient in keeping the freight in good condition. There seems to be a mystery about these false bottoms, similar to what used to exist about links and pins in the old link and pin days. They go out by the hundred and disappear and nothing more is known of them.

The Locomotives for France.

These are the engines which are partly responsible for the vast amount of comment on American competition in Europe, as they are, we believe, the first American engines to go to France.

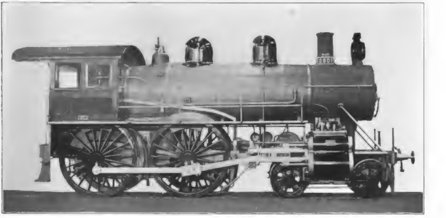
They have none of the frills which we sometimes find on locomotives of the land of the Heilman moving power plant, but are sensible, business-like looking engines. They were part simple and part compound, the simple engines having piston valves.

The gage is a little odd, 4 feet 9⅝ inches. Cylinders of the simple engines are 17¼ by 26; compounds are 13 and 22 by 26 inches.

The boilers are 58 inches, but carry 215 pounds of steam on both simple and compounds. Fireboxes are copper and the grate contains 25.58 square feet. There are 282 flues 2 inches in diameter and are 12 feet 1 inch long, giving a heating surface of 1764.2 square feet. Firebox heating surface is 128.4 square feet, or a total of 1892.6 square feet.

Driving wheels are 84¼ inches, truck wheels 36 inches. Weight on drivers 69,760 pounds. Total 117,985 pounds. Tenders were supplied by railroad.

The links had oil wells or cups forged solid above the eccentric rod pin, and the top distance piece or block formed an oil well for the link block. Although this is not uncommon on the other side, it is not found very frequently in this country. We shall expect good reports from these engines.



BALDWIN ENGINE FOR FRANCE.

The other day a prominent Western miller, whose railroad traveling has made him an expert, rode over the Baltimore & Ohio Railroad from New York to Chicago for the first time. He had heard the merry jests and the caustic remarks which were based on the conditions that used to obtain, and kept "his eyes open." After reaching home he wrote a congratulatory letter to General Manager Underwood, and among other flattering things said: "I want to assure you that I enjoyed the trip over your line very much indeed. I think the ride from New York to Washington is a most delightful trip; it was just after the rain, when nature was at its best. I will withdraw all my invidious remarks. I kept waiting for the 'swinging motion' on the way from Washington to Chicago, but did not discover it."

We have received a new supply of tractive power and of train resistance computors. Our stock of these useful aids for busy men was burned up in the fire, and the first intention was not to have any new ones made, but the demand for them was so great that we changed our mind. Under the tonnage system of train rating a great many men have had a stimulated interest in telling at a glance what load a locomotive ought to pull, and that is what the tractive power computor does. The computors are sold by Angus Sinclair Company for $1 each.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Air-Brake Instruction Room of the Erie Railway at Hornellsville, N. Y.

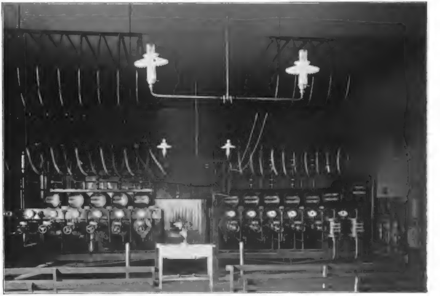
A correspondent writes thus enthusiastically of the air-brake instruction room of the Erie Railway at Hornellsville, N. Y.:

"The accompanying cuts show interior views of the neatly arranged air-brake instruction room of the Erie Railway Company at Hornellsville, N. Y., which is visited daily by large numbers of employés whose duties it is to operate or maintain the automatic air brake.

"The cuts illustrate the arrangement of the details so nicely that a further description is unnecessary, unless it be to call particular attention to the location of this room, which, indeed, is a very desirable one, as it is remote from all noise—a feature which is usually overlooked by parties who have the authority to install similar plants of this kind.

"Mr. Ross Kells, who is in charge, is a very affable and painstaking gentleman, and it goes without saying that his efforts have been conducive of much good, not alone in elevating the standard of air-brake repairs, but also in bringing about a more general understanding among the men in road service, which is bound to lead up to a smoother and more successful handling of trains.

"This is only one of the many of these plants that the Erie Company has established at different points along their line, and it is convincing evidence that the officials are heartily in accord with the recent conclusions of Master Mechanics' and Master Car Builders' Associations when they recommended that air-brake instructors should give equal attention to enginemen, trainmen, shopmen, and that the work of instructing these parties be followed up more closely in the future than it has been in the past."



A VIEW OF THE AIR-BRAKE INSTRUCTION ROOM ON THE ERIE RAILWAY AT HORNELLSVILLE, N. Y.

Detroit Proceedings of the Air-Brake Association Now on Sale.

On account of unforeseen and annoying hindrances in the preparation of the Detroit Proceedings of the Air-Brake Men's Sixth Annual Convention, it was impossible to place the book on sale June 15th, the usual time, and the time promised in our June issue. These hindrances, however, which caused a month's delay, have been finally overcome, and the book is now on sale, copies having been sent to all members and persons ordering.

The bobk teems with up-to-date air-brake information, and is plainly the best medium by which air-brake men may keep advised of what is going on in the air-brake business. The History and Development of the High-Speed Brake, The Pressure Recorder Chart Applied to Air-Brake Practice, How the Efficiency of Air Pump May Be Increased and Maintained, Methods for Preventing the Breaking Apart of Trains, The Air-Brake Department of Railways, Steam Heating Railway Trains, and the Master Car Builders' Standard Code of Tests of Triple Valves are subjects written upon and discussed by the representative and best air-brake men in the business. Price same as usual—75 cents for leather bound, and 50 cents for paper.

CORRESPONDENCE.

Lame Maintenance of Air-Brakes.

Editor:

The condition in which the air-brake equipment is kept up on the freight and locomotive equipment on some roads is very bad. They do not even try, or seem to care, whether the air brakes are in a good, reliable, working condition.

Here are a few of the defects of the air brakes on the freight equipment on some roads, which make it impossible for the engineer to do good braking: No attention whatever is given to adjusting the slack, allowing the piston to travel the hanging on by only three or four threads; train pipe very poorly clamped to car, allowing it to work from 3 to 4 inches.

Why do some companies mark their triples and brake cylinders cleaned and oiled when they are not? The other day I came across a car marked cleaned and oiled about three months ago. This car was cut out, and as I wanted to know what the trouble was, I cut it in. No air came into the auxiliary, so I disconnected the crossover pipe at the triple to see if the strainer was clean. I found it perfectly clean, and by opening the cut-out cock in crossover pipe air flowed freely out of pipe, showing that the strainer in

Now let us take a look into the locomotive equipment. An air pump was reported running hot, and, on being examined, it was found that packing rings were badly worn, and instead of fitting two new ones and boring out air cylinder, as ought to have been done (as cylinder was over 1-64 larger at ends than in center), only one new packing ring was put in. On fitting new receiving and discharge valves at roundhouse (all the above refers to roundhouse work), they are not given the proper lift. And why is it that they do not put on a competent man, at least, who knows about air pump and brake-valve work, to make the repairs?

A VIEW OF THE AIR-BRAKE INSTRUCTION ROOM ON THE ERIE RAILWAY AT HORNELLSVILLE, N. Y.

whole length of the cylinder. I have seen fast stock trains where half of the brakes were defective for this one reason, and most of the other ones were suffering from something else, making it impossible to stop where you want to. Triple valves are not cleaned nor oiled, and are so badly gummed that they will only work in emergency. Air blowing out of the pressure retainers on account of defective rubber seat of emergency valve, is a common trouble.

I have found quite a few lately in that condition; also gaskets leaking between the triple valve and the auxiliary reservoir; leaking packing rings in triple piston, causing brakes to stick; union loose next to drain cup in train pipe, sometimes train pipe was all right, too. I then took triple valve down, and found it so badly gummed up and the feed ports clogged solid, so no air could pass through. Packing in brake cylinder leaked so badly that all air flowed by it, and the only way to get the piston to move was by making a continuous reduction of 30 pounds, and then piston would travel out the whole length of the cylinder, and then come back again.

A very bad practice followed by some engineers, is pouring from ½ to 1 pint of engine oil into the hose on head car and blowing it back into the train. They will tell you that it makes their brakes hold better—but what about the hose, strainers and triple valves?

Many air pumps are packed with a cheap rubber packing, which will only last a month if given good care; but when the pump has to be run at full speed to maintain train-line pressure, the packing burns out quickly.

It is a very bad practice to allow oil to be drawn in through the receiving valves of an 8-inch pump, as it gums up your pump, brake valve and governor, also causing your pump to run hot by stopping up discharge pipe, and puts in air-valve cages.

In piping engines on some roads, it looks as if they try to use all the elbows they could find. I have counted as high as ten on one engine; that is, in train pipe from the front of the pilot to the

rear of tender. The air must have a hard time in finding its way out in double-heading.

C. F. SUNDBERG,
C., M. & St. P. Ry.

Sioux Falls, S. D.

[We are glad to get this communication just at this time. The "little voices" in "93,012," which appears elsewhere in this issue, tell the same story as our correspondent.—Ed.]

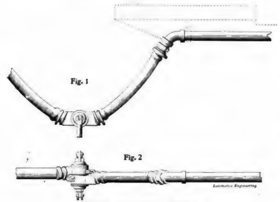


Fig. 1

Fig. 2

NEWLY PATENTED HOSE COUPLING.

Valuable Suggestions on Piping Air Pumps.

Editor:

Almost every road that I have been over, since starting on my travels, I find has more or less difficulty in lubricating the 9½-inch pump satisfactorily, and I am sometimes asked why it is that one pump of this class will run smoothly without groaning on a small quantity of valve oil fed regularly, while others groan almost continually, although the supply of oil allowed them is quite liberal.

At first I attributed the trouble to the leakage of oil through the joints of the governor connection where the nuts of the governor were not screwed up perfectly tight, and to leakage through the drain cocks whenever they were not a good fit, or through carelessness or forgetfulness they were not closed while pump was running. I have also found the trouble complained of to be aggravated whenever the pipe supplying steam to the pump was tapped into the boiler head, and was not taking dry steam from the dome.

On some engines where the pump is located pretty well forward, as on heavy freight engines with extended wagon top, I have found an extra drain cock tapped into the elbow of steam pipe, a drain cock somewhat larger than the usual size; and on engines so equipped the pump groaned more than on those without the extra drain cock. On others the steam pipe was carried down to a point much lower than the pump connection, and then bent upward to make the connection, so that there would be a low point or depression in the pipe, in which condensation could accumulate when the pump throttle was closed, or oil could lodge and not go to the pump while working.

I have been under the impression that the oil fed by the lubricator was vaporized as soon as it reached the steam in the pipe, but I was informed recently by a representative of the Galena Oil Company that such was not the case, as they had made experiments to determine this fact, and found that the oil remained in the same form and condition as when it entered.

This being true, it follows that the pipe taking steam to the pump should have a continuous incline from the point where the lubricator is connected to the cylinder connection, and that all depressions in the pipe should be taken out, so that no traps or cavities would be present to hold oil, which would certainly be carried into them by gravity, and thus be prevented from going to the cylinder where it belongs.

Noticing that pumps which take dry steam from the dome, and whose steam pipes have a gradual incline all the way from the lubricator to the cylinder connection, governor connection and drain cocks being tight, do not give trouble by groaning, I am forced to the conclusion that the trouble can be obviated if proper methods are used in the manner of piping.

J. P. KELLY.

Pittsfield, Mass.

Newly Patented Hose Coupling.

Editor:

Please find enclosed a copy of my train-pipe air hose coupling. I have tried it on passenger coaches and freight cars; it works nicely. No more angle cocks cut off by tramps or other persons, as this does away with angle cocks entirely.

The device consists in the combination, with an air-brake coupling-valve having its stem extended beyond the coupling-head, of a valve-setting lever having an eccentrically-arranged fulcrum through which it is directly connected with the projecting portion of the valve-stem to operate in bearing contact with an outer portion of the coupling-head, so that in one position of said lever the valve will be unseated and locked against a closing or seating movement, and in the other position of the lever the valve will be free to seat automatically when the two coupling-heads are separated.

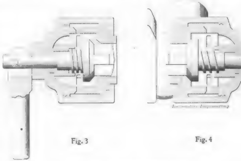


Fig. 3

Fig. 4

NEWLY PATENTED HOSE COUPLING.

Fig. 1 is a side elevation showing the hose-coupling and a portion of a train-pipe to which the hose is directly connected without the interposition of the usual angle-cock. Fig. 2 is a plan of the

same. Fig. 3 is a vertical transverse section through the valved portions of two disconnected coupling-heads, showing the lever of the coupling-valve so set as to prevent the valve from seating, and Fig. 4 shows the lever of the valve in the other head set to permit automatic seating and unseating of that valve.

R. S. Brown,
Engr., L. & N. Ry.

Bluefield, W. Va.

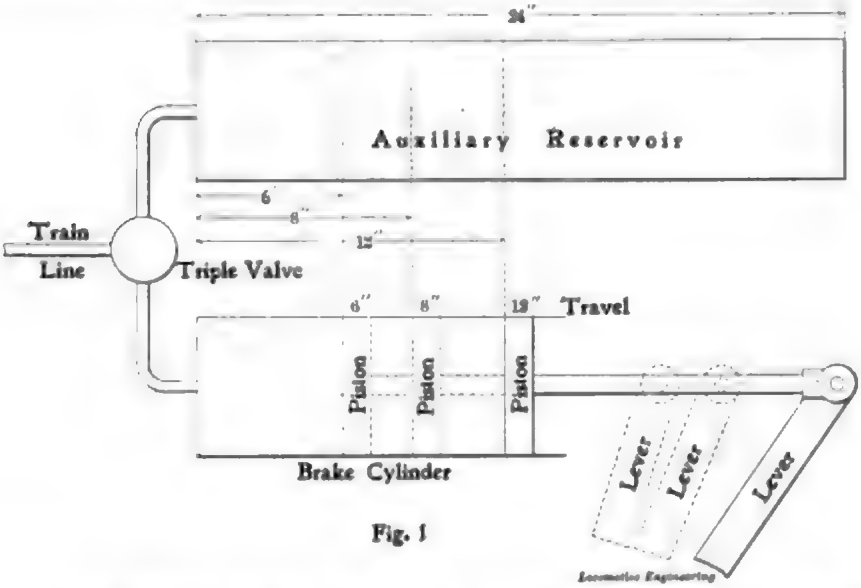


Fig. 1

Graphic Explanation of the Equalization of Auxiliary Reservoir and Brake Cylinder Pressures.

Editor:

I am not going to pin my faith to a vacuum, and I believe there are many with me, otherwise Locomotive Engineering would not have the circulation it has. Most railroad men to-day want something more tangible than a vacuum, otherwise why should the automatic air-brake be so popular? I say this notwithstanding your associate editor of the woolly West made me acknowledge the vacuum theory when the brake piston moves out. This he did the other day while he was my guest on a trip over the road, and as it was not very nice of him, the only way I have of getting even is to write you about it. Now that I have "seen" my duty and "done" it, I want to ignore his vacuum and tell your readers something about this mysterious equalization of pressures between the auxiliary reservoir and the brake cylinder.

If 15 pounds of steam will do a given amount of pushing, 30 pounds will do twice as much, friction being ignored. This being the case, I find from experience that it seems very queer to many men why an application of 30 pounds will not hold a brake twice as hard as one of 15 pounds.

I have for several years used a somewhat different means of illustrating the connection between piston travel and the resultant cylinder pressure than has usually been employed. I find that it is one thing to put a gage on a car and show by that, and quite another matter to explain clearly why *thus* is *so*.

It may show good discipline when they tell us that the foreign drilled soldier is a machine and simply does what he is told to do, without thought or reason; but how does that compare with our intelligent volunteers who do what they are told to do *with* thought and reason—as *men*, not as *machines?*

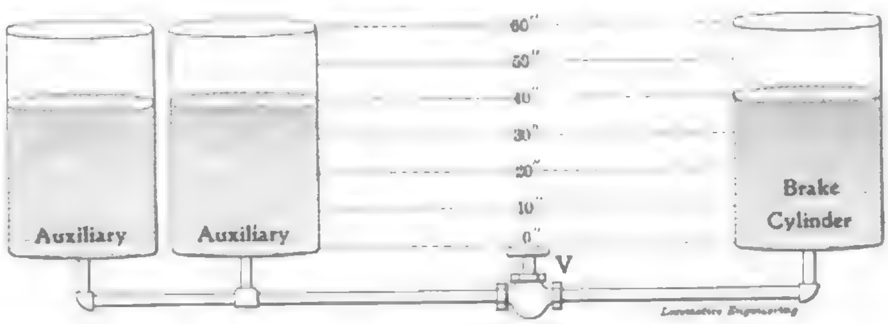
The same is true, comparing railroad men of years past with most of those in the fight to-day. Formerly they would concede (but they did not believe it) that "20 pounds is a full application, and more than that is a waste of air," because, as they said, "Westinghouse says so." Now they want to know why, and if the 20 is a fixed amount for all cases.

In Fig. 1 I show a brake cylinder 12 inches long and above it an auxiliary reservoir. For all practical purposes we will find that an auxiliary, to be properly proportioned, would be about twice as long if it were of the same inside diameter as the cylinder. Hence, I make the auxiliary 24 inches long.

Now if the piston could travel far enough (24 inches) to cause the cylinder to be equal in capacity to the axiliary, their equalized pressure would be one-half whatever pressure was in the auxiliary before the triple opened communication to the brake cylinder. But, as Fig. 1 shows, the brake piston can travel but 12 inches, which makes the auxiliary at least double in size. Eight goes in 24 three times, and hence the auxiliary is three times as large as the cylinder with an 8-inch travel. Similarly, a 6-inch travel gives an auxiliary three times as large as the cylinder. Thus the equalizing points would be at two-thirds the original auxiliary pressure for a 12-inch travel, three-fourths for an 8-inch travel, and four-fifths for a 6-inch travel as will be clearly shown.

Now, air is like water in some respects. Both are fluids, and neither one will run uphill—that is, they will never go higher than their source.

Suppose now we represent the 12-inch travel by two barrels filled with water and another one empty. The filled barrels represent the auxiliary, which is twice as large as the cylinder (the empty barrel) in this case. If we permit 10 inches of water from the two filled barrels (the auxiliary) to flow through the valve to the empty barrel (the brake cylinder) it is evident that it will make 20 inches of water in the empty barrel. If the barrels were all 60 inches high, as shown, and we allow 20 inches to flow from the auxiliary (the two filled barrels), it would make 40 in the cylinder (the empty), and the water in the three would be level. Do you think that any more water will flow now they are level if you take the coal-pick to valve V or otherwise waste your breath because the empty don't fill clear up? By the way, did you ever put her in emergency or reduce all the train line in service, when, after a full service application, you saw you were going to run by?



Triple Valve

FIG. 2. ILLUSTRATING 12-INCH PISTON TRAVEL.

Thus we see that Fig. 2 represents a 12-inch piston travel—the worst possible to apply; and yet reducing 20 from 60, or one-third, is a full application, and the pressure all equalizes(is level) at 40, or two-thirds of 60.

To reason out the proportions for 8-

inch or 6-inch travel, we take Figs. 3 and 4.

In Fig. 3 the three filled barrels represent the auxiliary, and the one empty again the cylinder; for, as shown in Fig. 1, the auxiliary is about three times the capacity of a brake cylinder with 8-inch travel.

If we could get 20 inches to flow from the three filled barrels in Fig. 3 to the empty one, the latter would be full and the others only at 40. But again, we must remember that water don't flow uphill. Try letting out 15 inches, and you see three times 15 is 45—and they are all equalized. Don't waste more muscle now on valve V, for it won't do any good and may not permit the valve to work so easy when you go to close it.

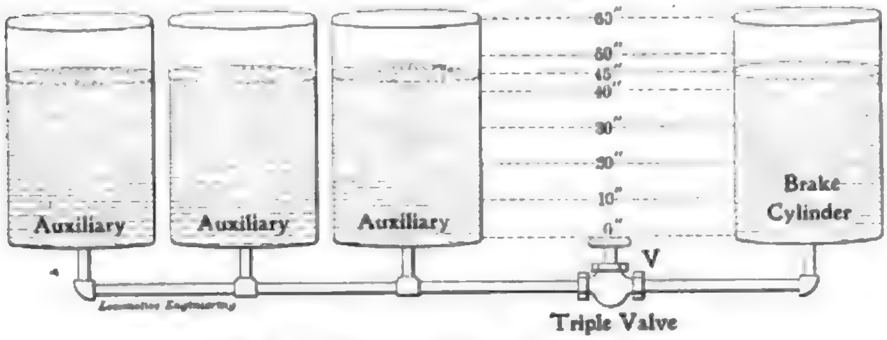


FIG. 3. ILLUSTRATING 8-INCH PISTON TRAVEL.

Here we have for an 8-inch travel that 15 from 60, or one-fourth, is a full reduction, and 45-60, or three-fourths is their equalizing point.

Fig. 4 shows the 6-inch travel, where the auxiliary is represented as being about four times as large as the cylinder. Now we can get but 12 inches to flow from the four filled barrels (leaving 48) into the empty barrel (cylinder), making 48, and they are equalized.

I won't go any further this time, for I don't want to be too hard on "Doc" and the rest of you; but if anybody is interested in this kind of approximate reasoning, let him couple up these three cars and try setting them all alike and releasing them altogether, etc., etc., or I will take that up some other time.

E. W. Pratt,
Gen. Air-Brake Insp., C. & N. W. Ry.
Chicago, Ill.

Testing Brakes on Trains.

Editor:

Our road not being equipped with slack adjusters, I have adopted the following method of testing air brakes at terminals: I pump the train up to full 70 pounds pressure and apply brakes in emergency. Afterwards I make a half service application of the brakes to determine as to leaks in the graduating valve, slide valve, etc.; in fact, any leaks on the auxiliary side of the triple.

I find that there is a difference of from ¾ to 1¼ inches in piston travel of brakes applied in emergency and those applied in full service. In trying the brakes in emergency I can come nearer getting a correct running piston travel than by trying them in full service. I do not see how I could give the triple valve as well as the whole brake a more rigid test than by an emergency and, after recharging, a half service application of the brakes. I have had some comment made on this method of testing air brakes, and would be very glad if you would give me your opinion concerning the matter.

H. H. Briggs, Jr.,
Genl. Foreman, K. C., M. & B. R. R.
Amory, Miss.

[Withal, the test is very good and quite satisfactory, although some persons reasonably object to the use of the emergency application in testing brakes, as that throws a too frequent and unnecessary shock upon the foundation gear. A better method, probably, to test for running travel when standing still, would be that recommended by the Air-Brake Association, which consists of carrying 90 pounds on the testing plant and making only service applications in the tests. It has been found that this higher train-pipe pressure will give an equivalent piston travel without subjecting the brake rigging to the emergency-application shock.—Ed.]

The Voorhees Air-Brake System.

Editor:

I notice in current number of Locomotive Engineering a description of my controlling device for air brakes, as per specification originally filed in Patent Office. Subsequent to that date some additions to and modifications of construction have been made which bring the idea to a more complete stage in its development.

Previous to the publication of the article mentioned, I tendered a description of the device in its present form, which was ignored. Having now set before your readers the original design, will you kindly show in your paper the improvement as shown in the accompanying photograph.

J. F. Voorhees.
3718 *Mantua Ave., Philadelphia, Pa.*

[As has been expained to Mr. Voorhees, the cuts illustrating his original device had been made and type for the descriptive matter had been set up before his letter, containing the description of his improved device, had reached us. We are not publishing his later improved device, because of lack of space and lack of general interest in the double train-pipe system. It has been truthfully said that "You can do anything with a double train pipe air-brake system, except sell it to a railroad company." Any person desiring further information on the system should communicate directly with Mr. Voorhees, who has made several inportant improvements in the system as published in our last issue.—Ed.]

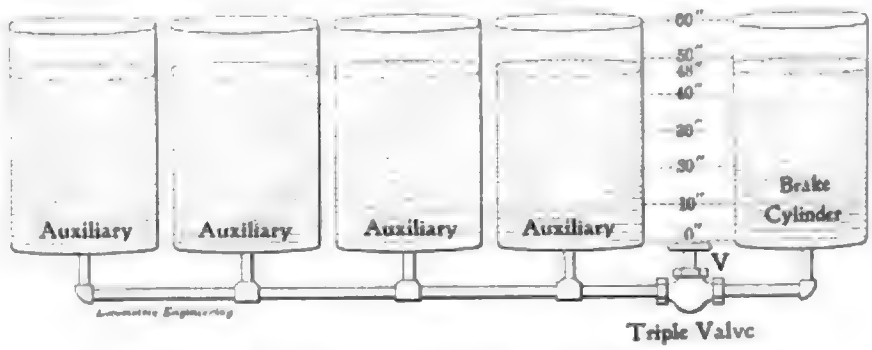


FIG. 4. ILLUSTRATING 6-INCH PISTON TRAVEL.

Brake Operation on Long Freight Trains

Editor:

Please advise me on the following: I am running a 9½-inch pump with 1-inch steam pipe, standard throttle and Westinghouse governor. I always have 190 pounds of steam, working daily from thirty to fifty air brakes, and running the pump throttle three-fourths open.

Recently two air brakes stuck forty-two cars back in the train, and conductor had to bleed the cars, which did not bother again, and had not bothered before. The

conductor then came over the train and threatened to report me to superintendent for not running my pump fast enough, although I showed him the gage registering 70 and 95. The reservoir pipe in the cab was so hot you could not hold your hand on it. I told him that during this hot weather I wanted to favor the pump all I could. He said I had no right to do this; if the pump ran hot, to burn it out and get a new one.

This seems to be the policy here, and I do not know of a 9½-inch pump running six months without repairs. I have never had an air-brake failure with this train.

Here is another case: We come in a station with twenty-five air brakes and pick up twenty more. In coupling up, the crew throws open both stop-cocks, putting emergency on twenty-five cars. Now, if there are 60 pounds of air in every one of those brake cylinders, I am unable to move until I have 60 pounds in train-line. Another man opens the stop-cock slowly, and I am moving out of town with 40 pounds on my train-line, and no brakes stuck.

My conductor claims a minute is long enough to pump up forty-five cars if pump is properly run. I often lay on a side track thirty minutes, and as our air pump exhaust is in the stack, I ease up on the pump until ready to go, giving it a chance to cool off and letting up on the fire.

Here is another: The company has issued orders that trainmen need try air only at terminals. I always leave air set at water tanks, and on several occasions have been unable to move because stop-cock was not opened on train. Is this practice wrong?

A case has come up where a hose bursted on a forty-car air-brake train. The engineer left his brake valve in full release until pressures equalized at 40, then in running position, with the intention of gaining a little excess pressure to kick off his brakes and move out of town. The conductor ordered him to throw his valve in full release, which he did, not one of the crew bleeding a car, all brakes being pumped off. Do you think it a sufficient cause for reprimand to carry 60 and 90 in forty-car trains, and thus having 30 pounds excess? "Subscriber,"

Engineer Fitchburg R. R.

Rotterdam Junction, N. Y.

[Of course, the first consideration is to have sufficient air pressure to safely and satisfactorily handle the train. If you can get that pressure and be saving of your pump at the same time, there would be nothing gained, and considerable be lost by unnecessarily running the pump at excessive speed and heating it. But even though you heat your pump, you should get the necessary pressure. That is the first consideration, even though the pump demands frequent repair. In coupling up air hose the angle-cock should be turned slowly, thereby preventing an emergency application of brakes. Neglect to observe this will cause trouble and loss of time. We infer that you cut off the engine to take water at the tank. If this inference is correct (which we believe it is, as you would otherwise not be obliged to open or close cocks, unless you also cut a crossing at the same time), we can say that your practice of leaving brakes set while you take water is all right. Under such conditions as very bad train-pipe leaks, as with a bursted hose, the D-8, or 1890 model, brake valve should be carried in full release position. With F-6, or 1892 model, the running position should be used in this case. It seems a little strange that a conductor should direct his engineer where the handle should be carried. The maximum train-line pressure of 70 pounds should be carried where practicable. If more than 20 pounds of excess is found to be advantageous, it should be gotten by raising the main reservoir pressure, rather than by reducing the train-pipe pressure carried.—Ed.]

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(53) J. D., Christ Church, New Zealand, asks:

Do you know of any instance of the triple piston being stuck through obstruction getting on the feed port? A.—No. If other persons have had such experience, we would be pleased if they would write us giving full particulars.

(54) J. K., Syracuse, N. Y., writes:

You give air valves, in the 9½-inch pump, 3-32 inch lift. You expect them to do good work up to what lift? A.—Some inspectors and repairmen renew the valves when the lift has increased to 5-32 inch; while others assert that good work is obtained with valves whose lift has increased to 3-16 inch, and even higher.

(55) J. K., Syracuse, N. Y., asks:

Why will a pump, if pounding from loose brackets or improperly clamped pipes, or similar causes, jar most as it reverses at the top? A.—The weight of the piston must be considered. On the upstroke it must be overcome; on the down stroke it is added to the force of the steam pressure, and meets the opposition of the air in the cylinder with a thump or pound; hence the jar referred to.

(56) J. A. H., Pine Bluff, Ark., asks:

What is the equalizing drum built in proportion to? A.—The capacity of the equalizing reservoir of the brake valve is so calculated that, in service applications, the discharge at the preliminary port shall be such as to cause the equalizing piston to rise and let out an amount of train-pipe pressure that will surely set the brake on a long train, and still not get quick action on a one-car train. Thus it will be seen that the size of the preliminary exhaust port must also be considered, and is equally important as the size of the equalizing reservoir.

(57) J. D., Christ Church, New Zealand, writes:

1. Is it possible for pipe scale or fins to get into the feed port of a plain triple valve and prevent the piston going down, when pressure is reduced in the train pipe? A.—1. While remotely possible, it is practically impossible, owing to the shape and small portion of the port exposed and great pressure exerted to move the piston downward. 2. If on the train pipe being again charged and the piston moved up so that it did not bear on the obstruction, that the obstruction would fall into the bottom of triple valve and cause no further trouble? A.—2. As this would depend upon the ability of the obstruction to first get into the feed groove, an answer may be taken from A.—1.

(58) L. K., Needham, Mass., writes:

We are having some trouble with sticky brake on the tender. If we make a reduction of 10 to 15 pounds, it will take 10 to 15 seconds to release. Note—The air is coming out of the triple-valve exhaust port from 10 to 15 seconds before brake will release. Triple valve is perfectly clean; piston travel, 7½ to 8 inches. We think it is in the brake cylinder. Spring is weak. Are we right? Please explain in your next number of Locomotive Engineering. A.—Possibly the piston spring is weak or broken, or the packing leather and cylinder are dry, thus causing a tardy return of the piston after the triple has been put in release position. Possibly, again, the exhaust port in the triple has been clogged by oil and dirt, so as to retard the escape of air from the cylinder. The time you give is not excessive for the escape of air from a 10-inch cylinder whose piston travels 8 inches.

(59) J. K., Syracuse, N. Y., writes:

We have gage in cab connected to brake cylinder; when brake is applied, hand goes up to 50, but drops to 20, then slowly rises to 30. Why does hand not hold at 50? A.—The cylinder packing or piping between the triple valve and brake cylinder is evidently leaking, and lets the pressure drop from 50 to 20. By that time, perhaps, the packing gradually forms to the cylinder, or the leaky piping, due to some outside influence, tightens so as to stop the leakage. The increase from 20 to 30 may be caused by back leakage from tender brake—say, leaky triple packing ring and gasket; or, what is more probable, the increase may be due to some connection to your gage. Say, for instance, that the gage does double duty to register main reservoir or train-pipe and brake-cylinder pressures, a three-way cock being used to cut one in and the other out; should this cock leak from one pipe to the other, the trouble would be accounted for.

(60) J. A. H., Pine Bluff, Ark., asks:

Why is train pipe for passenger cars

smaller than those used for freight cars? A.—There are two reasons, the first and primary of which is that quick, serial application may be assuredly had on trains of great length. Freight trains are the longer; hence, to give sufficient freedom to the movement of air in the long train pipe, the freight car pipe is made the larger. The second reason is that a sufficiently large volume may be had to draw from in emergency application of the brakes to increase the brake cylinder pressure about 20 per cent. Thus the 1¼-inch train pipe of a freight car has a volume which, in emergency, will give about 60 pounds in the cylinder. The greater length, although smaller diameter, of the 1-inch train pipe of a pasenger car is expected to give nearly 60 pounds in emergency, but in reality falls a little short of it.

(61) J. A. H., Pine Bluff, Ark., asks:

How long will it take a Westinghouse quick-action triple to charge auxiliary reservoir to 70 pounds, with 70 pounds main reservoir pressure to start from? A.—The time of charging varies with the older and later make of triples. Some of the earlier forms require nearly twice as long as those of recent manufacture. The Master Car Builders' code of tests requires that an auxiliary reservoir shall charge from zero to 70 pounds in 55 seconds, and under no circumstances shall it take less than 45 or more than 60 seconds. This is with a head of 90 pounds. With a head of 70 pounds, the time would be considerably longer. The condition of the feed groove and packing ring would be such important factors in the case that no time could be declared to cover valves as they are found in the various conditions of service. One might charge in 45 seconds, while another would require 2½ minutes. Perhaps a medium of about 1½ minutes would be a fair estimate.

(62) F. C., Sparta, Tenn., writes:

We have an engine equipped with a D-5 brake valve, 8-inch pump and late-style governor. We carry 100 pounds main drum pressure and 70 pounds train line. With just engine alone both pressures stand the same (100); but when engine is coupled to train of five to ten cars, pressures stand all "O. K.," 70 and 100. Rotary valve is all right; does not leak. We have taken the feed valve out and cleaned it, and it seemed to be all "O. K." Will you please tell me, through the columns of LOCOMOTIVE ENGINEERING, what was the trouble, also why it would be that way with engine alone, and then be all right with a train? A.—There is only one place for the pressure to come from that raises the train-pipe pressure to 100 pounds, and that place is the main reservoir. Hence, there must be a leakage past some point where the main reservoir and train-pipe pressures are separated. As your rotary valve is tight, there remain yet two principal places—the supply valve in the feed-valve attachment and the gasket between the attachment and the main body of the valve; the former of which may seem tight upon a casual examination, but in reality is not. The reason the increase is had on a light engine and tender, and not on a train of five or ten cars, is, that the piping on the former is generally quite free from leaks and of comparatively small volume; while the leaks in the cars are more numerous and consume all, and perhaps more air than leaks from the main reservoir into the train pipe.

Defects of Car Couplers.

We consider that Mr. J. W. Thomas, general manager of the Nashville, Chattanooga & St. Louis is performing a valuable service to all the railroads in the country by the systematic reports which he is collecting on causes for trains breaking in two and on all failures of car couplings or draft appliances. He requires trainmen to make a minute report about the cause of every accident to the coupling or its connections, and the information so collected is worked up into tabulated form which indicates at a glance the various causes for couplers failing. Mr. Thomas, who is an experienced engineer, has evidently been making a careful study of the coupler question, and his views thereon are worthy of acceptance as good engineering sense.

In a letter on the reports of coupler failures, published by the *Railroad Gazette,* Mr. Thomas says:

"1. The tail bolt and its key are crude affairs, and the source of many accidents, and should be discarded as rapidly as possible. In eighteen months there have been but two cases of yoke straps giving way. One of these straps was evidently bent cold, the fibre of the metal being so distorted as to leave only about one-quarter of an inch of solid metal where it was bent. Unfortunately the other strap was not sent in for examination.

"2. In this day of heavy trains, the vast majority of which are partially equipped with air, the link and pin have developed a marked weakness.

"3. Draft springs must be of sufficient dimensions. Many cases of M. C. B. couplers parting can be traced to weak draft springs.

"4. Lock rods and chains should receive more attention. Some chains are too short. In a number of instances chains with long links have been caught between the coupler and end of car, or deadwood, and bent so as to shorten the links sufficiently to raise the lock when the drawbar is pulled out more than usual.

"5. M. C. B. couplers must be more closely inspected and worn parts replaced.

"6. Some new M. C. B. couplers have contour lines which are barely within the limits as set forth by the M. C. B. Association. Many are of very poor material. Many others are poorly fitted up. With such couplers conductors find it difficult to determine the causes of failures.

"7. Records of all cases of trains parted are of much value, especially where the couplers are of the M. C. B. type. Broken parts should be examined. Such investigations will at least be a partial guide as to what couplers not to purchase. Trainmen and inspectors should be encouraged to investigate the cause of M. C. B. couplers parting, particularly if the cause is obscure.

"8. Many of the couplers on the market need a lock to the lock.

"9. Scores of steel knuckles are full of blow-holes, and, of course, do not withstand shocks, especially when coupled to a car equipped with link-and-pin drawbar.

"10. Enginemen should be thoroughly instructed as to the handling of brakes, especially where trains are partially equipped with air.

"11. Posting the Train-Parted Reports on the bulletin boards has a decided tendency to make the men more careful, and reduces the number of break-in-twos. The posting of these reports has created no little interest among the men on the N. C. & S. L. Inspectors, enginemen, firemen and trainmen become familiar with the weak points of the different couplers, as well as of the draft rigging, and thus learn to take precautions against danger."

Join the Traveling Engineers' Association.

The officers of the Traveling Engineers' Association are trying to increase the membership of the organization, and are sending out application blanks, in hopes that they will secure a material increase of the membership before next convention. Parties eligible for membership are traveling engineers in active service, whether assigned to duty on the entire system of a railroad or on a single division of any road. Their assistants, when such assistants have charge of a division and are responsible for the condition of the engines and the discipline of engineers and firemen to the same extent as the traveling engineers, provided that such assistants are not engaged in one line of duty only, such as instruction in firing coal properly or inspection of engines in roundhouse. Second—Those who have been traveling engineers and have been promoted to other positions of railroad service. Third—Experts in air-brake practice, employed by railroads or air-brake companies. Fourth—General foremen, roundhouse foremen, when they have been promoted from the position of locomotive engineer. Any active member of the association who is promoted to the position of master mechanic, superintendent of motive power, superintendent or general superintendent may be made an honorary member. Persons, eligible under this list who have not already become members of the association, ought to send in an application to W. O. Thompson, secretary, Elkhart, Ind.

PERSONAL.

Mr. M. A. Carmody has been promoted from trainmaster to be superintendent of the Allegheny Railroad.

Mr. F. Hunt, general foreman of the Port Arthur route at Stanberry, Mo., has been transferred to Sheveport, La.

Mr. James C. Cassell has been appointed general superintendent of the Norfolk & Western, with offices at Roanoke, Va.

Mr. Charles Peck has been appointed assistant to the general foreman of the Savannah shops of the Plant System.

Mr. N. G. Pearsall has been appointed general manager of the East Louisiana Railroad, with headquarters at Covington, La.

Mr. J. W. Dean has been appointed trainmaster of the Atchison, Topeka & Santa Fé at La Junta, Col., vice Mr. T. H. Sears, resigned.

Mr. J. R. Slack has been appointed assistant superintendent of motive power of the Delaware & Hudson, with headquarters at Albany, N. Y.

Mr. R. M. Sheats, superintendent of the Western division of the Baltimore & Ohio at Grafton, W. Va., has been transferred to the Chicago terminals.

Mr. C. L. Ewing, division superintendent of the Southern at Selma, Ala., has been transferred to the Birmingham division, vice Mr. A. J. Frazer.

Mr. A. J. Frazer, superintendent of the Southern at Birmingham, Ala., has been transferred to the Atlantic division, succeeding Mr. W. A. Vaughn.

Mr. W. E. Bensinger has been appointed roundhouse foreman of the Louisville, Evansville & St. Louis, vice Mr. Frank J. Moorhead, promoted.

Mr. L. E. Johnson has been appointed general manager of the Norfolk & Western, with office at Roanoke, Va. He succeeds Mr. J. M. Barr, resigned.

Mr. George F. Merchant has been appointed general superintendent of the Buffalo, Rochester & Pittsburgh. He was heretofore assistant to the president.

Mr. L. W. Berry succeeds Mr. W. G. Besler as superintendent of the St. Louis division of the Chicago, Burlington & Quincy; headquarters at Beardstown, Ill.

Mr. S. M. Roberts, heretofore acting master mechanic of the Brunswick & Western, has been appointed master mechanic, with headquarters at Brunswick, Ga.

Mr. F. A. Husted, superintendent of the Middle division of the Baltimore & Ohio at Cumberland, Md., has been transferred to the Western division at Grafton, W. Va.

Mr. Frank J. Moorhead has been appointed general foreman of the Louisville, Evansville & St. Louis, vice Mr. L. E. Butler, resigned; headquarters at Princeton, Ind.

Mr. C. E. De Haven has been appointed master mechanic of the Southern division of the Kansas City, Pittsburg & Gulf at Shreveport, La., vice Mr. W. J. Miller, resigned.

Mr. W. E. Chester, general foreman of the Central of Georgia at Columbus, Ga., has been promoted to master mechanic, in place of Mr. J. L. Whitsitt, transferred to Savannah.

Mr. William R. Mooney, trainmaster of the Boston & Maine at Concord, N. H., has been appointed superintendent of the Concord division, vice Mr. H. E. Chamberlin, resigned.

Mr. John E. Spurrier, superintendent of the First division of the Baltimore & Ohio, has had his jurisdiction extended over the Second division; headquarters at Baltimore, Md.

Mr. F. W. Main has been appointed purchasing agent of the New Orleans & Northwestern, with office at Natchez, Miss., succeeding Mr. C. G. Vaughn, assigned to other duties.

Mr. A. M. Wilson, division superintendent of the Philadelphia & Reading at Reading, Pa., has been transferred to the Reading & Columbia division, vice Mr. O. S. Doolittle, resigned.

Mr. T. H. Sears, trainmaster of the Atchison, Topeka & Santa Fé, has resigned to accept the position of superintendent of the Colorado & Southern, with headquarters at Denver, Colo.

Mr. J. W. Stokes has been appointed master mechanic of the Omaha, Kansas City & Eastern and Omaha & St. Louis, with office at Stanberry, Mo., succeeding Mr. C. A. De Haven, resigned.

Mr. Charles Galloway, trainmaster of the first division of the Baltimore & Ohio, has been appointed assistant superintendent of the First and Second divisions, with headquarters at Cumberland, Md.

The position of general superintendent of the Trans-Ohio divisions of the Baltimore & Ohio has been abolished, and the jurisdiction of Mr. Thomas Fitzgerald has been extended over the entire system.

Mr. E. G. Russell, recently appointed superintendent of the Morris & Essex division of the Delaware, Lackawanna & Western, has been advanced to the position of general superintendent of that road.

Mr. J. M. Graham, general superintendent of the Trans-Ohio divisions of the Baltimore & Ohio, has been appointed chief engineer with office at Baltimore, Ohio, succeeding Mr. W. T. Manning, resigned.

Mr. J. M. Barr, vice-president and general manager of the Norfolk & Western, has resigned to accept the third vice-presidency of the Atchison, Topeka & Santa Fé, with headquarters at Chicago, Ill.

Mr. Tracy Lyon, master mechanic of the Chicago Great Western, has been promoted to the position of general superintendent, with headquarters at St. Paul, Minn., in place of Mr. Raymond Du Puy, resigned.

Mr. James Paul has been appointed general foreman of the Savannah shops of the Plant System. He was formerly erecting foreman, and now takes the position left vacant by the promotion of Mr. F. S. Anthony.

Mr. John D. Campbell, of the Dickson Locomotive Works, is in Russia on business for The Dickson Manufacturing Company, Scranton, Pa. While abroad he expects to look up the scenes of his nativity in Scotland.

Mr. T. J. English, superintendent of the Chicago division of the Baltimore & Ohio, has been transferred to the Ohio and Midland divisions of the same road, with office at Newark, Ohio. He succeeds Mr. J. H. Glover, transferred.

Mr. G. H. Frech, superintendent of the New Jersey Central division of the Central Railroad of New Jersey, has been transferred to the New Jersey Southern division, with office at Long Branch, N. J., vice Mr. W. V. Clark, resigned.

Mr. Frank Hibbitts, trainmaster of the Erie Railroad, at Port Jervis, N. Y., has been promoted to the position of superintendent of the Jefferson division, with headquarters at Carbondale, Pa., succeeding Mr. G. W. Dowe, transferred.

Mr. W. Richmond, who for the past four years has been foreman of the Grand Rapids & Indiana Railway roundhouse at Cadillac, Mich., has been appointed master mechanic of the Lake Shore & Ishpeming; headquarters, Marquette, Mich.

Mr. J. T. Stafford, assistant master mechanic, has been appointed acting master mechanic of the Arkansas and Missouri divisions of the St. Louis, Iron Mountain & Southern, with office at Baring Cross, Ark., vice Mr. Mord Roberts, resigned.

Mr. Fred Wells has been appointed general foreman of Keene shops, of the Fitchburg. He will have full charge of all work pertaining to locomotive repairs. All shop foremen will report to, and receive their instructions from Mr. Wells.

Mr. W. G. Besler, division superintendent of the Chicago, Burlington & Quincy at Beardstown, Ill., has resigned to accept a position as division superintendent of the Philadelphia & Reading at Reading, Pa., vice Mr. A. M. Wilson, transferred.

Mr. Raymond Du Puy, general superintendent of the Chicago Great Western, has resigned to accept the position of superintendent of the New Jersey lines of the Delaware, Lackawanna & Western at Hoboken, N. J., vice Mr. E. G. Russell, promoted.

Mr. G. R. Huntington, chief clerk in the office of the general manager of the

Keegan's Ten Wheel Locomotive.

The Grand Rapids & Indiana Railroad have recently received four large ten-wheel engines from the Baldwin works which have a good many features designed by Master Mechanic James Keegan. They are intended for heavy passenger service during the summer resort season and freight at other times. They are now in freight service, doing exceptionally well.

The total weight is 134,330 pounds, of which 101,530 pounds are on the drivers, which have centers 56 inches in diameter. These wheel centers, as are all the castings, are of "steeled iron." Steel driving axles with journals 8 x 10 inches and truck journals 5 x 10 inches are used. The engine truck wheels are cast centers, with steel tires (Standard Wheel Company's make). The cylinders are 19 x 26 inches; solid pistons with cast-iron packing rings; steel piston rods 3½ inches diameter; Allen-Richardson valves, ⅞-inch outside lap, line and line inside, set with 1-32-inch lead when cutting off at 8 inches. The steam ports are short, 1⅝ x 16 inches; exhaust port, 3 x 16 inches. The loads which the engines are now drawing show that the steam distribution is very good.

The boilers set very high so as to get a deep firebox on top of the frames. The firebox is 63 inches deep. The grate surface is 96 x 42 inches; an area of 28 square feet. There are 148 square feet firebox heating surface, and 2,177 square feet of flue-heating surface; a total of 2,325 square feet. There are 290 flues, 14 feet 5 inches long. The boiler is straight, with butt-joint seams, having welt strips both inside and outside. It is made of 11-16 steel, is radial stayed with 1¼-inch stays and 1-inch staybolts in side sheets; 200 pounds per inch steam pressure is carried. There is a 4-inch water space at the narrowest points. Two Sellers 9½-inch injectors, a Nathan triple-feed lubricator, Leach sander, Cooke bell ringer and complete Westinghouse brake equipment are used. The fittings in the cab are very conveniently arranged so as to be easily reached by the enginemen at all times. The tool and oil boxes are in the end of water cistern or tank next to the cab, where they can be easily got at, are not in the way and take very little of the water space. The tender frame is of iron, with iron truck frames; 4,500 gallons of water is the capacity, while 10 tons of coal are carried; the coal space slopes from the back end as well as from each side towards the bottom of the pit. The loaded tender weighs 90,000 pounds.

The engraving and diagram give a very good idea of the proportions of these engines.

KEEGAN'S TEN-WHEELER, GRAND RAPIDS & INDIANA RAILROAD

Shall Engineers Wear Spectacles?

I noted an article in your journal entitled "Shall Engineers Wear Spectacles?" to which I reply:

This is a subject in which I have been specially interested for some time, and can be answered very readily, or at least according to my views. Shall engineers wear glasses? Yes.

As age advances changes take place in the system. Body fatigue occurs earlier and more often. The eye undergoes these various changes as well as any other organ of the body, and while physical impairment is relieved by medication and rest, the eye continues its work.

An applicant presents himself for examination for the position of fireman, and is found capable of passing the required tests. He is put on as a fireman. In the course of time his turn comes for promotion. He is able to pass again. His ambition is realized; he is an engineer. In this capacity, as in the former, he has given entire satisfaction. He is transferred from a hard, slow and long run to those of great responsibility, still competent and capable; but he now learns that the print or the writing on the orders has to be well illuminated with the torch and held farther away; also the signals are becoming a little indistinct. He then applies for relief and is directed to wear glasses, either for close work or distant vision. The wearing of glasses for the close work becomes an absolute necessity for everyone who has passed the age of forty-five years, provided that the eye is normal, and has been up to that age in all other respects.

It is not necessary to enter into the different troubles with the eye that compel the wearing of glasses, and the above statement should always be borne in mind.

The wearing of glasses is indicative of two conditions—disease and age. Of the former I will not speak. In regard to the latter, the former statement should be borne in mind, and if the engineer is wearing glasses the inference to be drawn is that he has been fitted properly and with them he has normal vision. Spectacles worn by engineers bear the same relation to those worn by those employed in other situations. To wit: First, proper adjustment and fitting; second, cleanliness. These are variable quantities, and are as important to the engineer as having the switch lights trimmed and cleaned

to distinguish the signal. They then depend upon the lamp trimmer, while for themselves they should attend to their own glasses. A competent and reputable eye man should be consulted, and obtain from him a prescription for properly correcting the defect of vision. The glasses should be made the size known to opticians as 00 and 000; this size used only for distance, while the reading glass size is not so important.

In the examination of employés in the train service motive department, I find (after consulting my records) 2,269 examinations for vision, color defects and hearing. Of this number sixteen have been recommended and do, according to the recommendation, wear glasses for distant vision; their vision being normal with the wearing of glasses. Of this number five were engineers and eleven were conductors. I have a record of those who are over forty-five years and wear glasses for reading, but will not report on them. You thus see that the percentage is quite small, being a trifle more than ½ of 1 per cent. wearing glasses for constant use.

Therefore, to my views, all engineers whose vision can be made normal with proper correcting glasses should wear them and supply themselves with an extra pair to be carried in their box while on duty, for with their use they are as safe to themselves, to the traveling public, and the property of the company is protected as well as if their vision was normal without their use.

In this connection I would state that the railroad employé and the company and the traveling public are better protected by having skilled oculists to conduct all examinations, as the employé is often discriminated against on account of some visual defect which can be benefited by treatment; the company by not employing an employé whose defect cannot be remedied, and the traveling public benefited by the knowledge that all precautions have been taken.

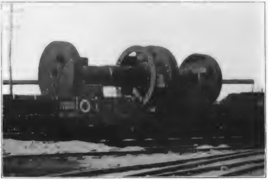
D. Emmett Welsh, M. D.,
Examiner, G. R. & I., C. & W. M. Y., D., G. R. & W.

A committee of the Traveling Engineers' Association, of which Mr. C. F. Schraag, Sedalia, Mo., is chairman, is investigating the Brown system of discipline without suspension. The committee has sent out fifteen questions to be answered, which will bring a great deal of useful information. There is a tendency in many quarters to adopt a modified method of Brown system of discipline without suspension, and in nearly every case where this is done it decreases the value of the system as originally introduced. In many cases where this is done it does not work satisfactorily, and officials get to regard it as no good, while in fact it has been themselves who have spoiled it.

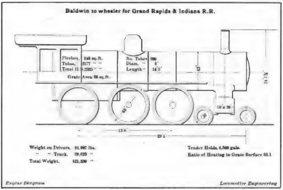
A Heavy Shipment.

The illustration shows the shipment referred to. It is a shaft with crank disks and generator fly-wheel hub assembled on it, all finished complete. The shaft was made by the Bethlehem Iron Company for an engine built by the Corliss Steam Engine Company, of Providence, R. I., for the Boston Elevated Railway. The total weight of the shipment was 170,400 pounds, and in order to transport it from South Bethlehem to the site at Boston, Mass., the Philadelphia & Reading Railway Company furnished two cars of 100,000 and 80,000 pounds' capacity, respectively, and blocked the shaft so that 60 per cent. of the weight was supported on the strongest car, and 40 per cent. on the other.

The shipment was made over the New Jersey Central, the Delaware & Hudson Canal Company, and Boston & Albany Railroad Company. The shaft is the first of three for the Boston Elevated Railway. It is of fluid compressed nickel steel, hydraulically forged hollow on a mandrel, oil tempered and annealed. It is 37 inches diameter in the center, with a 17-inch hole through its axis, and is 27 feet 10 inches long. The metal of which it was made showed tests of 50,000 pounds elastic limit and 18 per cent. elongation in test pieces 1 inch diameter and 10 inches long. Shipments approximating this size will frequently have to be made by railroads in the future.



A HEAVY SHIPMENT.



Mr. Ralph G. Harmon has been elected secretary of the Utica Steam Gauge Company, Utica, N. Y. He was formerly treasurer and general manager of the American Steam Gauge Company, of Boston. In sending out the notice of Mr. Harmon's election, the Utica Steam Gauge Company say: "By reason of this alliance and the increased facilities of our new, large and completely equipped plant, together with our past experience of forty years in the manufacture and sale of steam gauges, we assure the trade that we are in a better position than ever before to fill their wants in a prompt and satisfactory manner."

International Correspondence Schools At Scranton, Pa.

Among recent publications sent out by the International Correspondence Schools of Scranton, Pa., are two entitled "Special Courses," and "Electrical Engineering." They both give useful information concerning the operation of this admirable educational institution. The company have recently got out several cars which are sent around the country with instructors, one of which is shown on this page. Anyone interested in helping himself to a good education can obtain these pamphlets by applying to the company.

INTERNATIONAL CORRESPONDENCE SCHOOL CAR.

"93012"—With Apologies to Kipling.

BY F. M. NELLIS.

If you listen intently as you pass through the railroad yards, you will hear scores of little air-brake voices, each one striving to make itself heard and understood. If you understand their language and are in sympathy with these little voices, you will be told many interesting secrets. The little voice given life by the leakage in the hose coupling or train pipe, tells its story of neglect or abuse. The chatter of the emergency valve in the triple will explain to you its grievance. Likewise the blow at the retaining valve, the whistle at the exhaust port, the groan in the brake cylinder and the hiss at a loose joint or union will tell their tales of woe to your knowing and sympathetic ear.

Whether it was caused by the severe electric storm of last night, or by some unusual cause for grievance, is not known; anyhow, the little air-brake voices in the big railroad yard across the river were this morning unusually loud and demonstrative. They chattered and hissed and sputtered and called to each other with unusual freedom and noise. A brand-new air brake, just fastened yesterday to the sills of a Lackawanna box-car, listened with timidity and awe to the worldly talk of the brakes on the other cars about it.

"It beats h—l that I can't get some of the slack taken up in my brake rigging!" grumbled a Southern Pacific freight car that had just finished a transcontinental trip, and was now coupled to the Lackawanna car. "Only once, and that at Omaha, did I have a hole or two taken up on my dead levers all the trip across!"

"What do you mean by 'slack,' and where is 'Omaha,' please?" timidly ventured the new Lackawanna brake.

"Well, jar my slats, if I ain't hitched to a brand-new brake that never saw service!" muttered the veteran Southern Pacific brake. "But we were all novices once." Then in reply, "Well, greeny, you'll learn all that in time. You're too young to talk much yet. Just listen and learn."

"Hello! Southey," hailed a voice from No. 3 track, "don't be too hard on the kid." And then, "Where did you come from, and what are you doing here? The last time we met was three months ago, in Portland, Oregon. Your car was Chicago-bound with grain, and mine was loaded with merchandise for 'Frisco."

"Well, may I have flat wheels, if it isn't Northey!" exclaimed Southern Pacific, neglecting, in his pleasure at seeing an old friend in a foreign place, to answer the questions. "Here, kid, let me introduce you to my brother, Northern Pacific."

"Happy to meet you," stammered the youngster, his blush of embarrassment nearly melting the grease in his cylinder, as he caught sight, under the cars, of the grizzled veteran wearing a habitual cold, last winter's look of 20 degrees below zero. "It's kind of you older fellows to notice a novice like me."

"Poppy-cock! All poppy-cock!" croaked a voice below the novice on No. 5. "You'll grow old fast. Wait till you've had my experience, and you won't be so thankful and happy. Look at me! Only three years old—dyspeptic, rheumatic and paralytic—one foot already in my grave. Nearly dead! Yes! nearly dead—nearly dead enough to bury!"

"Give me tallow brake shoes, if there isn't an old guy just about to croak," observed Northey, pityingly.

"Don't ye recognize him, Northey? Don't ye recognize him?" called Southey.

"Don't, hey? Why, that's Old Eastern—'93012'—the old chap whose brake stuck and busted the wheel going down the Sierra Nevadas over a year ago—nearly pitched us all over Cape Horn! Wasn't you in the train? No?"

"Ahem! Is that you, Southern? Pardon me—Mr. Pacific, I should say."

"Yes, it's me; but cut out your Boston politeness, old man, and call me 'Southey,' as the other fellows do."

"Pardon me again, Mr. ——er Southey; I thought I recognized your voice. But permit me to correct your improper use of words. You should say 'burst,' not 'bust.' I trust you'll forgive and forget that little unpleasantness you just now referred to; won't you? I couldn't prevent it, indeed I couldn't."

Here Eastern's emergency check began to rattle, and it was easily seen that he was short of breath. After a choking spell he resumed: "The rubber seat of my emergency valve was nearly gone. A young person at Albany sought to do me a favor by giving me an oil-bath through the hose. It ruined my valve, I burst the wheel, and"——

"And nearly put us all out of the business," interrupted Southey. "But it beats me that you fellows here in the East still work that old oil-bath *via* the hose route. We Westerners quit that fifteen years ago. Why, a chump at Buffalo tried it on me, not very long since, and when he

opened the angle cock to let in the oil, I didn't do a thing to him. I soused him, I tell you, and made him look like the outer side of a freight car wheel."

"Why do they put oil into you, Southey?" asked Lackawanna. "I don't need any more. My triple valve is perfectly oiled, and my cylinder is fairly lined with Paragon grease. Aren't we all lubricated alike?"

"Well, wouldn't that frost you?" sneered a fifteen-year-old plain triple on a Transportation car. "You're greener than the verdigris on my triple valve piston. Bah! You ought to be put on the shop track till you learn something."

Southey held his breath in amazement at the novice's innocence. "Blow out my gaskets, kid, if you ain't green," he gasped. "But wait till you've seen service. In the meantime, listen, and stop making breaks."

"As for you, old Methuselah," contemptuously hissed Southey to Transportation, "you're old enough to have better manners when speaking with strangers. And," continued he, in a scornful tone which made the offender wither, "it's time you knew that a young quick action is better any day than an old plain triple."

"Oh! Southey—and you, too, Northey," interjected Eastern "how I wish I lived in your country! Here both of you are five years older than I, and in as good condition as our young friend Lackawanna here—to whom, by the way, I haven't yet been introduced. Ahem!"

"Proper and polite to the death," muttered Southey as he performed the introduction ceremony.

"As I was saying," resumed Eastern, "you are in good condition. You are well cared for. While some of our people are wasting time proving that it costs too much to care for us, your people are doing the work and saving money. You make double my mileage. The trainmen like you, and curse me; for I am only a lump of useless iron, adding weight to my car. I have had no attention since"——

Further talk was drowned by the rumble of an approaching train, hauled by a switching engine, down the main track to the pier.

"Just arrived from the West," yelled Southey, whose practiced eye caught sight of the bill-cards on the doors. "Look out for some of our fellows, Northey!"

"There they are! Hello! Santa Fé! How's Raton? Hey there! Rio Grande! Has Soldier's Summit flattened out any yet? Hello! Union! Did you bring me an automatic slack adjuster? Hooray Midland, old boy, to see you is joy. Ha! Ha!" shouted Southey and Northey familiarly as they recognized old friends in the passing train. "How are things in God's country, anyhow?"

"Robust and healthy fellows, those Western chaps; but just a bit woolly and profane," observed Eastern to Lackawanna, as the Westerners exchanged hearty greetings. "Nevertheless, I'd give ten reservoirs of pressure at 70 pounds if I had their health. Whew! this dust in my train pipe is choking me!"

"Hello! there's a new sound," ejaculated Lackawanna, as a strange voice shouted from an express train passing on the west-bound track. "What was that, Southey?"

"High Speed Brake, my boy! That was the High Speed Brake—the king of them all! Stops trains in half or two-thirds the distance required by other brakes. Good fellow, too! Not a bit stuck up, even though he is away above us common fellows. Gee! but he's strong. When he squeezes, you can bet the car wheels know it. Why, I've heard all the wheels under a passing express train shriek with pain and call out: 'Don't squeeze so hard, Mr. High Speed. For heaven's sake let up a bit! We'll stop rolling.' Although he squeezes harder than we can, he does it so intelligently and scientifically that he never slides a wheel. He is a winner, for fair."

"Is he healthy?" asked Eastern, gulping down a mess of dust and fine cinders that had worked through his strainer. "Do they give him oil and occasional attention? Or do they neglect him, let his hose drag, catch moisture that freezes in winter, and cinders, dust and sand which wear out valve seats, packing rings and leathers? That's me."

"He's looked after, all right," began Southey, "why he"——

"Sh! Sh!" excitedly interrupted a brake on a Central car which had hitherto remained quiet. "Hush up! Here comes the inspector. Don't let him hear you talking. He's sacred. He'll get angry and hit you clip over the triple with his hammer."

"Sacred be hanged. I ain't afraid of that counterfeit," irreverently growled Southey. "He's no inspector. Is he, Northey?"

"Don't act much like one," replied Northey, watching the squatty, dirty figure of a man approach, hitting a bolt here and a nut there with his hammer. "Oh! Gee! Get onto that inspector, will you? That isn't the kind we get out our way, you can bet. That fellow's a fake. Say! the song we composed on the Albany 'galvanizer' will suit this fellow, Southey. Let's sing it." The Pacifics then sang this jingle:

"He may be a baker—dough—dough,
Or horse-shoe maker—blow—blow,
A funeral director, or soft snap selector;
But an air-brake inspector, oh! no!"

"I tell you he's sacred!" whined Central. "Please hush up, you fellows!"

"I absolutely refuse to hush," stubbornly asserted Eastern. I'll make my leaks

sound as loud as I possibly can, and then maybe he'll fix me."

"That's a good scheme, Eastern, make your emergency valve chatter," urged Southey.

"Yes, and your slide valve leak," added Northey.

"And your cylinder packing groan," added an Erie car.

"And your retaining valve blow," ventured a Pennsylvania car.

"And your train pipe leak," suggested a Chesapeake & Ohio car.

"Hump yourself, Eastern, old man! You're up against it! Show up as bad as possible; that's the only way you'll get fixed," hissed Southey, as the figure approached nearer.

"Gentlemen, I'll do as you advise," said Eastern. "This is the last ditch. Here I shall put forth all my remaining energy in one last appeal to this inspector for a cleaning. Here I win or die."

The squatty figure stopped when it reached Eastern, and turned up the retaining valve to stop the blow there.

"Inspector, nit!" sneered Southey.

"Sacred shyster!" jeered Northey.

Then as the brake set on Eastern and the retainer weight was lifted, the blow resumed. The shyster then knocked the retaining valve to smithereens with his hammer, muttering an oath and smiling in a self-satisfied way. But as the blow at the pipe continued, the smile grew sickly and disappeared. The shyster then whittled a pine plug, drove it into the pipe, and the smile came to life again.

All this time Eastern was wheezing, hissing, buzzing and groaning, intent upon appearing sick enough for treatment. The other brakes looked on, hoping to see Eastern's triple get the badly needed cleaning and oiling, and his brake piston removed and the cylinder cleaned and lubricated. The shyster hesitated.

"Hump yourself, Eastern, old man. Your life depends on it now!" hissed Southey. "Chatter louder, groan worse, raise more h——l, and maybe you'll draw a clean yet."

But no such good fortune was in store for the invalid. The shyster cut the brake out, and it leaked off. Then, with a piece of chalk, he scrawled some hieroglyphics on the sides of Eastern's cylinder and auxiliary reservoir, and passing on, continued his inspection (?) trip.

"Well, may I never see Tehatchapi again, if that isn't a shyster trick for fair!" indignantly shouted Southey, as he read the hieroglyphics: 'Cylinder cleaned and oiled, triple cleaned and oiled, July 14, 1899.' The skin! The lobster!"

"Rotten!" ejaculated Northey. "And is this the kind of inspection you Eastern fellows get? Why, those letters and figures not only lie, but they keep good inspectors from doing the needed work. No wonder you have consumption, appendicitis and Bright's disease! That fellow wouldn't hold his job ten seconds in our country! Why, that inspection is a farce and fake, I tell you! It's dead rotten!"

"It's not very good at its best," admitted Eastern in a feeble voice. "It has been the killing of many of us." Then the emergency check in his triple gave one last gurgle, and poor Eastern's life passed out, leaving only the mass of iron hanging on the underside of the car, dead.

The Westerners were much affected by Eastern's death; but the Easterners didn't mind it much.

"Listen, fellows!" shouted Southey in a clear, ringing voice. "Know ye, all air brakes in this yard, that a good brake has just been killed by abuse and neglect. His number is 93012. When any of you meet a true inspector—one who understands us and our language—give him this number, so that old Eastern may be resurrected and made young again."

Then the switching engine came, shifted the cars about, and the voices ceased to talk. When the trains were made up, Southey, Northey, Eastern and Lackawanna were placed together in a train bound for the Pacific coast.

"Good-bye, Pennsy! And you, too, Erie and Central!" shouted Northey and Southey. "Good luck to you all! May you have frequent cleaning and oiling, tight train pipes, iron brake beams, 'Diamond S' shoes and automatic slack adjusters! Good-bye!"

As the train pulled out, the Westerners broke into a song something like this:

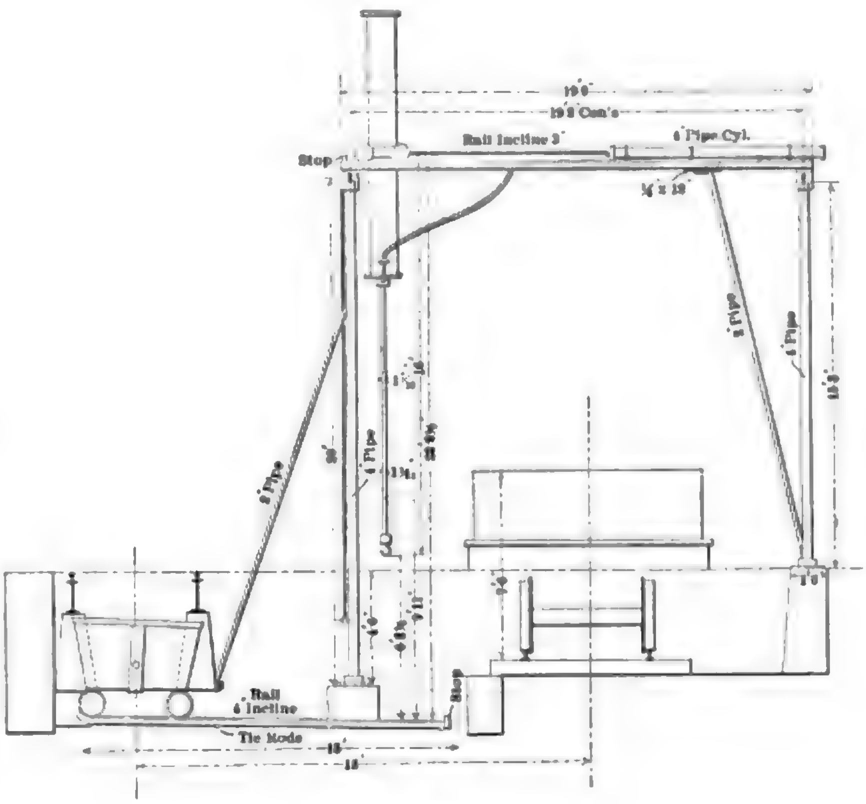
"Mere idle jest hath said it; but not a word of it's so!
'There's no Sunday west of La Junta and no God in New Mexico.'
We may sometimes break the Sabbath, and the third commandment crack,
But we never shirk our duty and work, nor let brakes be killed by a quack.
The East was quite a big dog when the West was but a pup.
We started a long ways behind, but we're swiftly catching up.
We'll give you points on air-brake practice, for our worst is as good as your best.
To h——l with your inspection—disgraceful reflection! We're off for the golden West."

As the song died out, the thoughts of the brakes left in the yard reverted to the novice Lackawanna and the dead Eastern. How long would it be before the old fellow's body would be resurrected? How far and how long would the mass of iron be carried, a dead weight? These were the questions that Pennsy, Erie and Central asked themselves.

As you stroll through the railroad yards along the trains, listen for these little voices. They are there and are speaking appealingly to you, imploring a rescue from the decline into which they are falling. They will also tell you of Eastern. Look out for him. His number is 93012.

Cinder Pit and Hoist.

The line-drawing is a sectional view of the cinder pit and air hoist for handling cinders and ashes, in use at the St. Paul shops of the Chicago, St. Paul, Minneapolis & Omaha Railroad. The engines are run on the track at the left, under which is arranged a steel bucket which rests on a skeleton truck. This truck is free to run on rails laid on a 4-inch incline, permitting a movement to the right of 15 feet, or up to the track provided for road cars for removing cinders. When the ash-pan of the locomotive is dumped into the bucket, the truck is then moved to the right, up to the car waiting to receive the load, and by means of air hoists the bucket is raised and dumped on to the car. The air hoists are arranged to have a vertical and horizontal lift which facilitates rapid handling. This plan has been in use some time, with very satisfactory results, providing a rapid and economical method of disposing of the cinders.



CINDER PIT.

The plan was designed by Mr. John Ellis, superintendent of motive power of the Chicago, St. Paul, Minneapolis & Omaha Railway.

A District That Does Not Want Railroads.

Some of the people in Pointe Coupee parish are not so much in love with railroads as they might be. Major Robert Strong, general agent of the Texas & Pacific, returned recently from that parish, and gives some interesting accounts of difficulties experienced by the engineers and workmen of the road in their efforts to build the extension from Baton Rouge to New Roads, some twenty-five or thirty miles distant.

"I was called up there to negotiate with several planters who would not allow our workmen to cross their ground," said Major Strong. "They simply sat out in the fields with shotguns on their knees and dared our workmen to approach. The result was that three or four men suspended the entire work of road construction. I went up there, negotiated with the old fellows, and finally succeeded in satisfying them that the company proposed to pay the costs of the crop which was being destroyed. This was the only contention, that the Texas & Pacific would not pay for the crops injured by the roadway crossing his lands. He was willing to donate the land to the road—the right of way. It was rather amusing to see the old gentleman and his son run our engineers out of the field."

Major Strong says that there are people in the northern sections of Baton Rouge parish who have never seen a railroad. He says that some of the people that far in the interior of the parish, and also in Pointe Coupee parish, through both of which new roads run, think that they will ship their freight over the road by putting it in baskets and setting them on tall posts by the side of the track, so that the conductor may snatch them as the train passes.

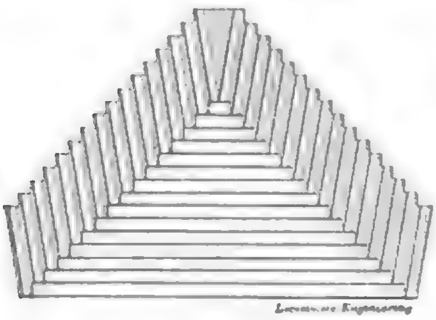
A Peculiar Exhaust Nozzle.

A recent issue of the *Patent Office Gazette* contained the exhaust nozzle shown with this. It has a series of steps, as will be seen, each step having a number of small holes or jets for the escape of exhaust steam to the stack. It is patented by Mr. John Whittle, of Boston, England.

It is not known what advantages are claimed, but the device does not appear to possess any particular merit. It is possible that a greater area of opening might be used and still produce sufficient blast, but when the friction of the steam in all the holes is considered the back pressure is sure to be at least as great as in the ordinary nozzle.

Single and Double Tube Injectors.

There have been some tests made in this section with single and double tube injectors to see which would deliver the feed water into the boiler at the highest temperature, taking it from the tank at about 55 degrees. All the tests made show the single tube injectors will deliver it into boiler from 30 to 40 degrees



PECULIAR EXHAUST NOZZLE.

warmer than the double tube injectors will. This proves what has already been proven before, i. e., it takes more steam from the boiler to give the proper expansion or impart the required velocity to the water in branch pipe to overcome boiler pressure on check with a single tube than with a double tube injector.

Now bringing heating feed water into the question, I claim a double tube injector will work water warmer than a single tube, for the simple reason it don't take as much steam from the boiler to condense in the feed water to get the expansion and overcome the boiler pressure on the check. Therefore, I claim when feed-water heaters are used for fuel economy (and that is what they are generally put on for) the injector that will work the warmest feed water is the most economical one to use. But I am meeting with some opposition to my views in regard to this, some making the claim if the water is delivered to boiler at same temperature from a single tube injector, say 200 degrees, and taking it from the tank at 55 degrees, there is just as much saving in heat units as there would be in taking a double tube injector and delivering it to boiler 200 degrees and taking it from tank at 90 or 100 degrees. These claims don't seem reasonable to me, although there are some reasonably smart men making them. I would be pleased to get your views or readers of LOCOMOTIVE ENGINEERING in regard to this matter.

I. F. WALLACE.

Altoona, Wis.

[Our correspondent is not entirely right in his conclusions. A double tube will put the water into a boiler just as hot as a single tube injector. Nor does it take any more steam from boiler to put the water in with a single tube than with a double tube injector when both are properly constructed. The injector that takes water at 90 degrees and puts it into boiler at 200 uses less steam than the one taking it at 55 degrees and delivering it at the same temperature as the other. Injectors do not make heat units, and when a good feed water heater is used an injector is not an economical instrument. When no feed heater is used it is very economical, as it puts back in the boiler most of the heat taken from it, the only loss being by radiation. Consequently the injector which uses the most steam puts the water in the boiler the hottest, other things being equal. It is not the number of tubes in an injector but the construction of them that causes the difference in their action.—Ed.]

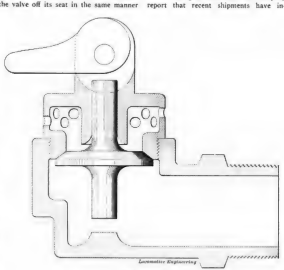
The society editress of a country paper writes about the fast engines of the Pennsylvania Railroad, and says that she "heard that the engine drivers were 6 feet 8 inches high, but she saw a little fellow driving the Pennsylvania Railroad machine who was not much more than 4 feet 6 inches high. As to the driving rods, about which she had heard so much, she declared that the engineer never 'switched' the engine at all, and used no rods of any kind; but he pulled a lever which released a plug in the big end of the front water tank, and the engine started of its own accord."—*Pittsburgh Post.*

The McConway & Torley Company, Pittsburgh, Pa., manufacturers of the Janney coupler and of a variety of other attachments for cars, have sent out a very handsomely prepared illustrated catalogue, showing the various parts of the products handled by the company, numbered for ordering, just as the details of the Westinghouse air brake are numbered. Every person connected with the ordering of appliances for cars ought to have this catalogue on his desk. It constitutes a particularly valuable book of reference for car couplers, vestibules, car platforms, locomotive pilots and a variety of other things belonging to railroad rolling stock.

Steam Chest Relief Valve.

The Norfolk & Western people make a relief valve with a cam attachment which can be turned over when the engine is standing where they do not wish it to be moved, and the relief valve will be held open. In case the throttle leaks or the cylinder cocks are shut the valve cannot work shut.

This is convenient when standing on the cinder pit or at any place where the engine does not have some one on or about her, as the amount of steam coming out of the relief valve will call attention at once. The cam when turned over holds the valve off its seat in the same manner that the Sellers injector cam operates the overflow valve. The cut makes this matter plain.



RELIEF VALVE.

A Fast Run.

On June 28th train No. 9, the Black Diamond Express on the Lehigh Valley Railroad, left Sayre 27 minutes late, at 6:56 P. M., and was detained at East Waverly six minutes by a block signal, leaving there at 7:04, arriving at Geneva at 8:05—74 miles, including two slow-downs, in 61 minutes. They left Geneva at 8:09; Manchester at 8:25, and ran 20 miles to Rochester Junction in 15 minutes, arriving there at 8:40; took on two cars, making six cars in all; left at 8:49 and ran to Buffalo, 69 miles, in 68 minutes; arriving there at 9:57, two minutes late. This includes two slow-downs and the crossings and slow speed through Buffalo yards. The whole distance, 178 miles, was made in 158 minutes running time, including all the slow-downs. Thirty-three miles from Burdett to Geneva Junction were made in 23 minutes. Several miles were made in 35 seconds each.

Engine 670, with 19 x 26-inch cylinders, 76-inch drivers, carrying 180 pounds of steam, drew this train. Engineer Wm. Owens and Fireman Chas. Dildine had charge of her. She is Atlantic type, with Wootten boiler, and was recently rebuilt by Master Mechanic S. J. Knapp. She came in cool and ready to make the trip over again.

The Chicago Pneumatic Tool Company report that recent shipments have included a large number of tools for Europe, one large order to South African Republic and one to Australia. The factory of the National Pneumatic Tool Company, of Philadelphia, the control of which has recently been acquired by this company, is running to its fullest capacity both day and night, as is also the case with the St. Louis factory, it being necessary to do this to keep pace with the orders.

The Berlin Iron Bridge Company, of East Berlin, Conn., are feeling very cheerful over the large steel foundry building just completed in Berlin, Germany. This is a large building covering about 60,000 square feet. The firm ordering it have been considering American structural work for several years, but this is the first time the Berlin Iron Bridge Company could compete in price.

Gilman-Brown Emergency Knuckle.

An exhibit which attracted much attention at the Mehanical Convention was the Gilman-Brown emergency knuckle. The value of this invention is readily realized when it is known that the knuckle will fit almost every coupler of the Master Car Builders' standard type. Its simplicity is shown in the accompanying engraving.

GILMAN-BROWN EMERGENCY KNUCKLE.

The emergency knuckle has been put upon the market by the Railway Appliance Company, of Chicago, after exhaustive tests to prove the efficiency of the device. This Railway Appliance Company was formed by members of the Sargent Company, which is a guarantee that the business will be conducted properly.

The Allison Manufacturing Company have just completed a contract for Westmoreland Coal Company's 80,000-pound-capacity hopper gondola coal cars, new class "Gk," Pennsylvania Railroad Company's standard. These are the first cars of this pattern built.

The Ajax Manufacturing Company, Cleveland, have issued a new leaflet illustrating their bolt header. Seven modest claims are made for the machine. Anyone who is thinking of ordering a bolt-header should send for this pamphlet.

The Westinghouse & Electric Manufacturing Company have favored us with another batch of bulletins or catalogues on transformer fuse blocks, Shallerger integrating wattmeters, railway motors, generators and rotary converters, and belt-driven railway generators. Needless to say, they are very neatly gotten up, and as they are perforated for easy binding, are sure to be preserved.

Reports having been circulated lately to the effect that the New York Air-Brake Company had a contract with the Russian Government to equip one-half of the rolling stock of the cars belonging to the Government railways with air brakes, we have made inquiries and find that the reports are not true. The Westinghouse Air-Brake Company have the exclusive right to equip all the cars for one year with their brake. If it is not found efficient at the end of that time other brakes may be tried.

That energetic maker of metal polish, Mr. George William Hoffman, of Indianapolis, Ind., reports that his business is particularly brisk at present, and that he is receiving new customers almost every day, while old ones increase their orders.

The Buffalo Forge Company, Buffalo, N. Y., have recently sold an automatic engine to be used for running a pressure blower in connection with a boiler plant at the Paris Exposition, to be held next year.

We have received from the passenger department of the Long Island Railroad Company four illustrated pamphlets, showing up and describing the glories and attractions of Long Island as a summer resort. All the pamphlets are got out in excellent style, both in letter type and engraving. One of them seems to tell the whole story of Long Island without the aid of any reading matter. It is just an attractive pamphlet of pictures.

The Waterbury Tool Company, Waterbury, Conn., have put upon the market a very ingenious ratchet which can be operated from almost any angle. It will be found exceedingly convenient for work in the confined spaces under locomotives, and appears to us one of the most sensible inventions we have seen for a long time. We advise shop foremen and others interested in getting work out expeditiously to send for an illustrated catalogue of this tool.

"Brazing by Immersion" is the title of an illustrated pamphlet issued by the Joseph Dixon Crucible Company, Jersey City, N. J. It describes very fully some very important improvements in the art of brazing, and will therefore be found of much value to those who have anything to do with brazing operations. To those so situated, we would say, send to Secretary Long and get a pamphlet. It speaks for itself much more eloquently than anything we can say.

CONTENTS.

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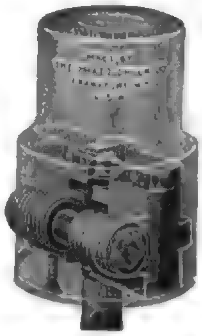

See That Little Dog?

That's a great little dog. Stays right there on top of the jaws all the time and attends to business. That business is the holding of drills so they can never slip. The trick is, this little dog holds the flattened end of the drill, and all the jaws have to do is to exert just enough pressure to prevent the drill from falling out, and center it.

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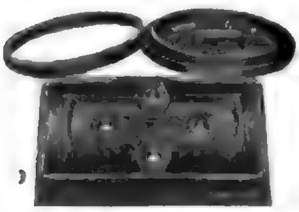

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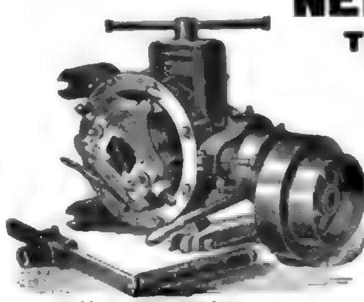

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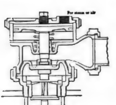

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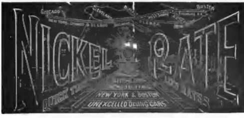

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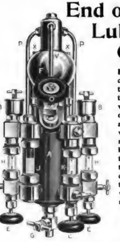

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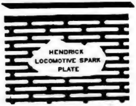

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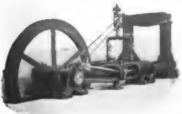

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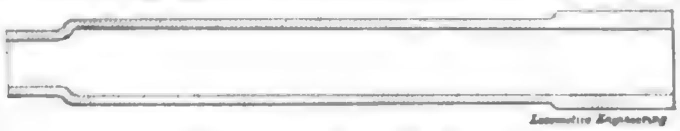

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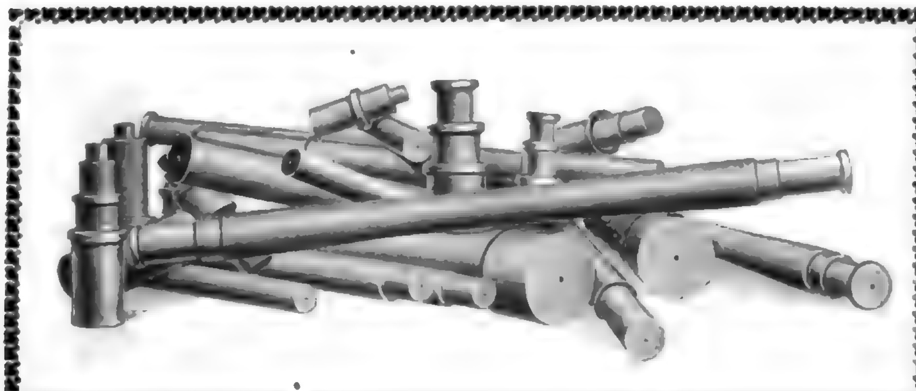

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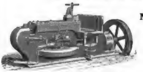

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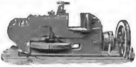

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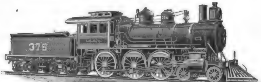

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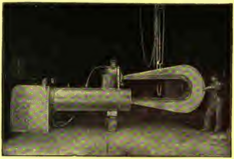

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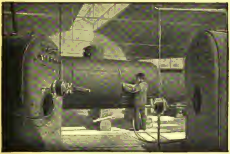

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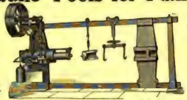

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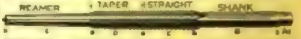

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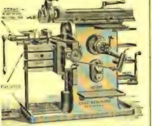

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Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

95 Liberty Street, New York

September, 1899

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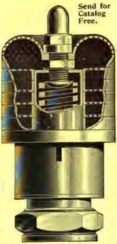
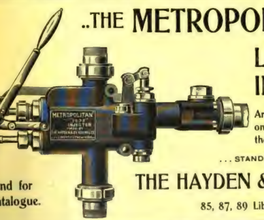




Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XII | 95 Liberty Street, New York, September, 1899 | No. 9

The Vanderbilt Engine and Corrugated Furnace.

The locomotive shown in the annexed engraving and the line cut on page 389 represent the most radical advance in locomotive design that has been made since the firebox was first adopted for the furnace of a locomotive boiler. The boiler, which is the novel feature of the locomotive, was designed and the details worked out by Mr. Cornelius Vanderbilt, Jr., and the engine was built in the New York Central shops at West Albany, and is now at work on the Mohawk division, pulling freight trains.

VANDERBILT ENGINE WITH CORRUGATED FURNACE.

Mr. Vanderbilt is a graduate of the Sheffield Scientific School of Yale, and has devoted himself very assiduously to mechanical engineering. The locomotive boiler has received special attention, and, like many other engineers, he believed that it was possible to design a stronger furnace than the ordinary firebox, and this corrugated tube is the result.

The illustration of the boiler is so good that very little description is necessary to make details of design entirely understood by any practical man. A corrugated furnace, 64 inches diameter and 11 feet 2¼ inches long, is placed eccentrically in the back of the boiler shell, which is 85⅝ inches in diameter at the furnace part. The huge tube is supported from the top by sling stays in the front by the tube sheet, and in the back by being flanged to the outside sheets. Thirty inches back of the tube sheet there is a cast iron support for the grates, and above it is built a brick wall about 20 inches high. The portion of the furnace to the front of the brick wall forms a combustion chamber. All the ashes from the fire pass through the largest opening seen at the bottom of the furnace into the ash pan secured beneath. The smaller opening is to remove any ashes that may accumulate in the combustion chamber. The furnace supplies 191.68 square feet of heating surface, and the tubes, 332 in number, 2,164.56 square feet, making a total heating surface of 2,356.27 square feet. The grate area is 35.2 square feet.

The furnace was made by the Continental Iron Works, Greenpoint, L. I., and is the largest corrugated furnace ever constructed.

The engine has cylinders 19.5 x 28 inches, driving wheels 61 inches diameter, and the boiler carries 185 pounds of steam pressure. Worked out by the usual formula, this gives the engine 27,446 pounds tractive power. The driving wheel centers are cast steel, the driving wheel journals are 9 x 12 inches, main crank pin journals 6 x 6 inches, main side rod bearings 6½ x 5¼ inches, forward and back 5 x 3¼ inches. The truck wheels are 33 inches diameter and have Krupp steel tires. The weight of the engine in working order is about 160,000 pounds, 113,300 being on the drivers and 46,700 on the trucks.

The engine had two 3-inch consolidation safety valves, and she steamed so freely on the first trial trips that the safety valves would not control the steam pressure within fifteen pounds, and they have been compelled to put a third valve on.

The first trial trip of the engine was made on August 15th with fifty cars, mostly empty. The run from West Albany to Dewitt, 143 miles, was made in about ten hours, there having been considerable delays through congestion of trains. The engine steamed very freely, as has already been mentioned. The return trip was made after giving the crew

three hours' rest, and they started with sixty-seven empties, and made the run in eight hours and fifteen minutes. When the tracks were clear the engine, without difficulty, maintained a speed varying from 25 to 30 miles an hour. There were scarcely any cinders thrown from the stack. The pop valves were set at 180 pounds, and with both of them blowing fiercely the steam ran up several times to 195 pounds. On the last test made by an ordinary engine belonging to the New York Central, to see how much the steam pressure could be run above that set by the pop valves, they found, with the very best and fiercest fanned fires, they could only run seven pounds above the specified pressure. This, of course, means that the steam generating capacity of this boiler is much greater than that of the ordinary kind. The evaporation was extremely high, being 8.6 pounds of water per pound of coal.

The chief merit of the corrugated furnace is that it does away with the need for staybolts, which are such a fertile source of annoyance from breakage, causing endless work and much danger. Without staybolts this furnace is much stronger than the ordinary firebox, and is likely to sustain the strains incident to changes of temperature better than straight sheets, as the corrugations will take care of horizontal movement.

There is nothing experimental in corrugated furnaces, for they have been used for many years in marine boilers. It was a bold conception to have a corrugated tube made large enough to fulfill the functions of a furnace in a large locomotive boiler. The thing is, to some extent, experimental for locomotives, and we cannot predict any line of weakness. If the hard test of service demonstrates that a corrugated furnace is durable and free from cracks, the invention will make a revolution in locomotive boiler construction.

Valve Setting Extraordinary.

Some years ago there was a jovial, good-natured and withal a very shrewd engineer nicknamed "Pep," not for any peppery temper, for he had a disposition as calm as a summer morn; his voice was the only boisterous thing about him; he got the name somehow and it stuck to him.

He was running a Manchester engine just out of the back shop which was not exhausting exactly square. "Pep" wanted her squared up, and had asked the foreman a number of times to do the work, but was always put off on one pretext or another.

One evening when he was pulling out of the yard past the shop with a freight train, he spied the foreman standing in the shop door listening to the beat of the engine, so when he hooked her up, instead of notching the latch in the quadrant, he let the lever pull back and forth between the 10-inch and the 6-inch notches, which made her sound very lame, and he kept up this movement as long as he was in hearing of the shop.

When he got back to the shop next day, the foreman had his force all ready to set the valves.

After inspecting the motion work, her valves were run over, but it was not found out what made her so lame; so the steam chests were taken up, the valves turned over and measured, the steam ports measured and compared with the other side, and nothing left undone to locate the cause of the lame exhaust.

When they finally finished their work, without making any serious alterations, and pronounced her valves set "O. K.," she was so good that "Pep" used to say that the steam and smoke came out of the stack and floated back over the train in square-cornered chunks.

Traveling Engineers' Convention.

The following is part of a circular issued by Secretary Thompson, of the Traveling Engineers' Association:

"The Seventh Annual Convention of the Traveling Engineers' Association will be held at the Grand Hotel at Cincinnati, Ohio, commencing September 12th, at 9 A. M. The manager of the hotel has made a rate of $2.50 per day, two persons in a room; one person in a room, $3, except on the parlor floor. The convention hall will be in the hotel.

"The Pullman and Wagner Palace Car people have made a one-half rate to all members and their families. All those that travel in Pullman cars will pay fare going, taking a receipt for the same, and, upon presentation of your receipt together with your credentials, their district superintendent at Cincinnati, Mr. C. C. Chase, will furnish passes for the return trip. Those traveling in Wagner cars will pay their fare going, taking a receipt therefor, and, upon presentation of the same together with your credentials to their district superintendent, Mr. F. E. Cook, Grand Central Station, Cincinnati, he will issue free transportation returning."

Fast Run on the Vandalia.

A notable run was made over the Vandalia line lately by one of their locomotives built a short time ago by the Schenectady Locomotive Works.

The run was with Vandalia line regular train No. 20. The train passed Clayton 6 minutes late; passed transfer station 1 minute late—distance 18 miles; time 14 minutes, or an average of practically 46 seconds to the mile for 18 miles, or 78 miles an hour. Part of the distance was made at somewhat higher speed. For instance: Cartersburg was passed 7 minutes late and transfer station 1 minute late. Distance 14.93 miles, or practically 44 seconds per mile for 15 miles, or about 82 miles per hour.

The train consisted of eight cars—two postal cars, one combination coach and baggage car, two day coaches, two sleepers and one dining car. The locomotive is engine No. 16, and is one of the new eight-wheel passenger locomotives recently built for the Vandalia line, and illustrated in May, 1899, issue, LOCOMOTIVE ENGINEERING, on page 225.

The cylinders are 20 x 26 inches; drivers 78 inches diameter; weight on drivers 85,000 pounds; total heating surface 2,241 square feet; grate surface 30.07 square feet.

A Mechanical Stoker.

While in Cincinnati recently we saw a mechanical stoker that had been tried on the Chesapeake & Ohio Railroad with fairly good results reported.

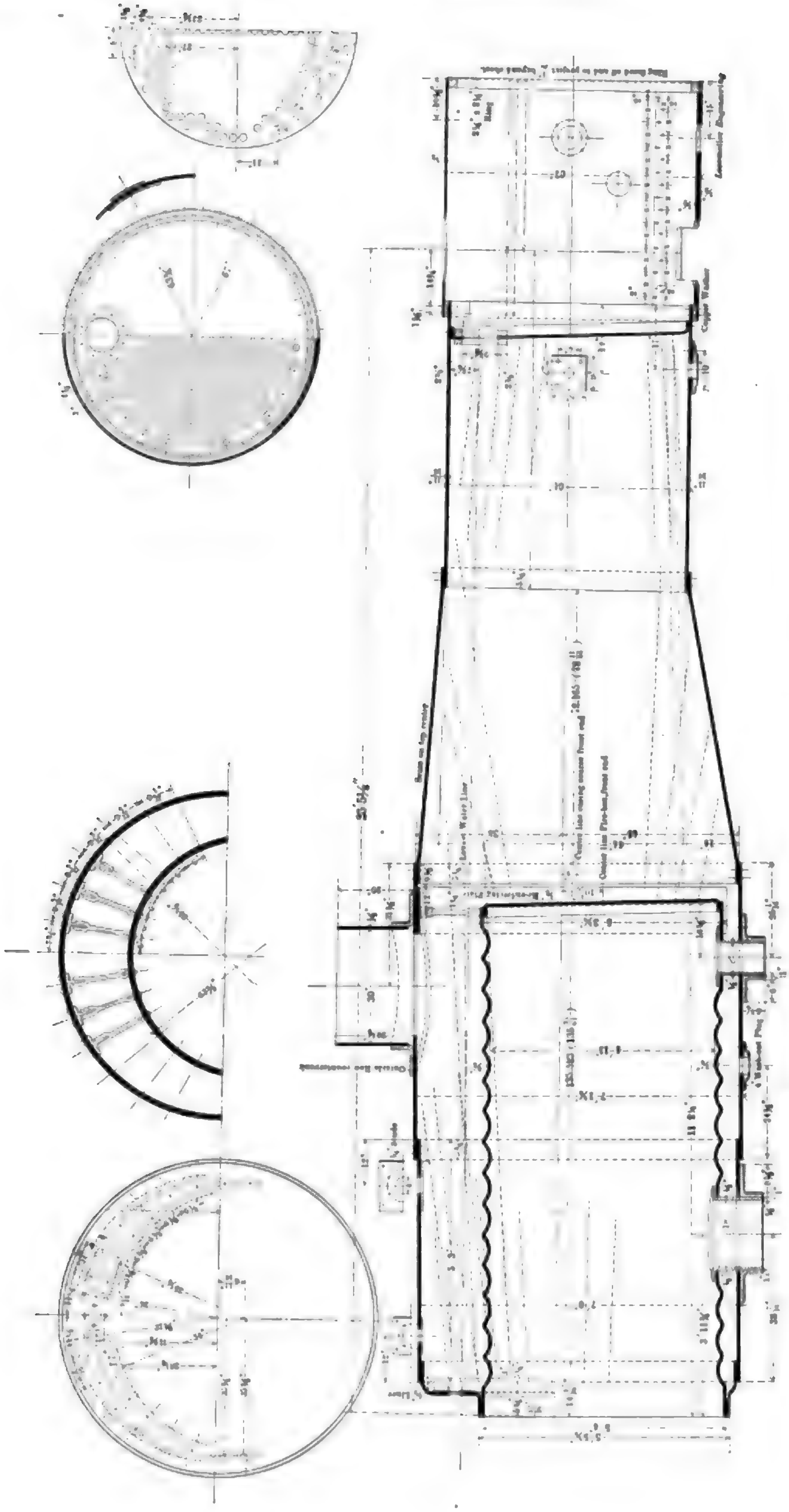
The coal is put into a hopper by the fireman, from there it feeds down into a 6-inch cylinder, and a piston operated by steam throws a small charge of coal—from 4 to 6 pounds—through an opening in the firebox door. This coal can be given force enough to go clear to the flue sheet or drop at any part of this distance, even close to the door. At the same time it is spread out evenly over the surface of the grates from side to side. The supply of steam and coal can be regulated for light or heavy work by the crew.

If it can be perfected so as to work on a locomotive, the smokeless firing trouble will be shifted from the shoulders of the fireman, for small charges of coal scattered evenly over the fire at short intervals is the ideal smoke preventative.

The inventor, Mr. Kincaid, expects to have one in working order at the time of the Traveling Engineers' convention at Cincinnati—September 12—and submit it for their criticism, and he hopes for their approval.

Mechanical stokers are nothing new, but so far their field has been limited to stationary boilers. Most of them handle fine coal only; this one can handle moderate-sized lumps.

It has been notorious for years that railroad companies in this country are badly imposed on by the owners of private car lines. By some means or other nearly all these lines manage to get a great deal of their repairs done by the railroad companies free of charge, and the cars of private lines are notorious for having such mechanism as air brake and couplers in bad order. The same state of things appears to exist to a great extent in Great Britain, for at a meeting of the Royal Commission in England, where cars and car mechanism were under discussion, Mr. Acworth, a well-known lawyer, made the point that, according to the Board of Trade figures, private owners' cars failed nearly twice as much as the railway companies' cars, and so led to many more accidents.



NEW YORK CENTRAL LOCOMOTIVE BOILER WITH CORRUGATED FURNACE.

DESIGNED BY MR. CORNELIUS VANDERBILT, JR.

Traveling in Alaska.

A little more than two years ago Mr. Robert B. Reading, who had been for several years division master mechanic of the Manhattan Railway, of New York, and was acting as superintendent of the Continental Match Works, at Passaic, N. J., suddenly became struck with the Klondike fever. The fever came in very severe form, so much so that he stood not on the order of his going, but went, and the next news his friends heard of him was that he was working his way over glaziers in the neighborhood of Dawson. After he had dug through glaziers for a considerable time and did not find that they contained so much gold as he expected, he turned his eyes backward to the joys of railroad life, and was for some time employed on the White Pass & Yukon Railway.

He came home last year in the dead of winter to thaw out, and of course, one of his first visits was to the office of LOCOMOTIVE ENGINEERING. He had brought a variety of photographs along, from which we select those shown. Mr. Reading gives the description of each photograph in a brief note, which will give the reader just as much information as we have in our possession.

1. Our friend Bob at Lake Bennett.

2. Steamer "F. H. Kilbourne" on Lake Marsh. Photograph taken from bow of steamer "Flora," running in opposite direction. These steamers run from the head of "Miles Canon" to the head of Lake Bennett, a distance of about 120 miles. The "Kilbourne" is a steel boat, shaped similar to the whale-back, and is built in nine sections, each of which is a watertight compartment. These sections were hauled over the White Pass in the winter of 1897 on sleds and were put together on the shores of Lake Bennett. The boiler is a "sectional pipe" type, of a rather peculiar "breed," and seems to make steam very freely with the poor wood used as fuel. The engine has two high-pressure cylinders, one on each side of the boat, directly connected to crank pins on either side of the stern paddle wheel. Engine and boiler were packed over the trail with the sections of the hull. The boat draws but 8 inches when loaded. The hull is about 60 feet long. I spent three rather uncomfortable days on this steamer, together with thirty others, as passengers from Miles Canon to Lake Bennett in September, 1898.

3. View of Klondike City (just across the Klondike River from Dawson), taken September 29th, 1897, the day we landed, after a month's trip. The boats on the beach are those used by the different parties to transport themselves and "grub" (a year's outfit) from Lake Bennett to Dawson, 600 miles. These boats were all built by the men who used them, at Lake Bennett, the lumber being hand-sawed out from trees. While trying to get ashore here I slipped off a cake of ice and had a good bath in the Yukon.

4. Homer Rapids, near Bennett. Typical rapids in an Alaskan River.

5. Shop Yards of White Pass & Yukon Railroad, at Skagway, Alaska. The building with all the smoke jacks is the roundhouse, and the one this side of it is the machine shop. The passenger train is on the main track, and is making a stop at the shops on its way up the mountains.

6. Just before a "pot latch" or Indian dance at Sitka, Alaska.

7. Roundhouse, turn-table, ash-pit and engine No. 4 of the White Pass & Yukon Railway, at Skagway, Alaska. The roundhouse has seven stalls, and is first class in every respect.

8, 9 and 10. Scenery along the White Pass & Yukon Railway.

ENGINEER TURNED MINER.

STEAMER ON LAKE MARSH.

The famous Stephenson Locomotive Works at Newcastle, England, have been sold to a new company. It is the intention to extend the works and put in a great deal of new machinery.

Along the Queen & Crescent Route.

In LOCOMOTIVE ENGINEERING for August was published an article from Superintendent W. J. Murphy, detailing the methods used on the Cincinnati, New Orleans & Texas Pacific Railway to do away with the smoke nuisance on passenger trains, with an engraving of one of the trains, showing the absence of any emission of smoke.

A representative of LOCOMOTIVE ENGINEERING made a round trip on one of the limited trains from Cincinnati to Somerset, Ky., 158 miles each way, and noted that when running along working steam the firing was absolutely smokeless. At the time of putting in coal when shut off, or just at the instant of shutting off, a very little brown smoke was sometimes seen over the engine, but none was visible from the rear of train, nor did any smoke or gas come into the coaches. Mile after mile was run, easing up for or stopping at stations, shutting off at the top of steep grades or for slow ups, and no smoke visible.

On the down trip a moderately hard article of bituminous coal was used; returning, a softer coal, with about the same results. The coal was not picked out or selected; it was used just as it came from the mine.

The engine was 19 x 24 inches, with 68-inch driving wheels, extended wagon top, with a deep firebox equipped with a brick arch having air tubes through it and four 2-inch air openings on each side, about 12 inches above the grates. There are 1,830 square feet of heating surface, and the boiler carries 175 pounds of steam. For the methods by which the good results were attained Mr. Murphy's article is referred to.

While the matter of smokeless firing is particularly looked after on the passenger engines, it must not be inferred that the work of the freight engines is neglected.

The engines, as far as possible, are all fired to produce the same results, and it is unusual to see a freight or yard engine making any smoke around the depots. The abolition of the smoke nuisance is not the only good result attained; a high economy in coal is also brought about. A coal premium system, introduced January 1, 1897, by President S. M. Felton, is in operation, which applies to all road engines.

A certain allowance of coal is made for each class of engine and each class of service, which is based on pounds of coal used per coach mile in passenger service and on a unit of 100 tons per mile in freight service. This allowance is changed from month to month as the conditions of weather, etc., change. All engineers and firemen who use less than the allowance receive premiums proportionate to the amount of coal saved. The amount used is made up from the coal tickets given by each engineer. The amount on the tender when he takes the engine, as well as any taken on during the trip, is charged against the crew taking her out, and credit given for the amount on hand when they give up the engine. This is compared with the allowance, and for half the amount saved $1 per ton is allowed, 50 cents to the engineer and 50 cents to the fireman. The premiums are paid from the pay car in cash; from fifteen to twenty-five crews receive premiums each month; the amounts vary from a few cents to $10 to a man, and the crews drawing the heavy trains get the most premium money. There is also a semi-annual good service premium paid, of which we will give the details later.

In addition to these up-to-date methods of firing coal, which have been practiced a long time, there are many other points which attract attention when riding over the line, which is single track.

The staff system is used in crossing the bridge over the Ohio river, one being carried between the bridge approach in Cincinnati and Ludlow, and *vice versa*. Another staff is taken at the south end of Ludlow yard and carried to the top of the big hill at Kensington Heights, about 5 miles.

VIEW OF KLONDIKE CITY.

With the exception of a few miles near the Ohio river, the road is rock ballasted. It is in good shape. Part of this trip the speed was up to 60 miles per hour, and rode good. On account of the rough country and numerous watercourses crossing the line, it is a succession of cuts and fills, with numerous curves. Some of the scenery, especially along the Kentucky river, which the road crosses on a bridge nearly 300 feet above the water, is grand. The blue-grass section around Lexington is a delightful panorama of fine stock farms. All the cattle guards and wing fences at highway crossings are whitewashed, which serves as a warning notice to all passers by, as well as locating them plainly for engine men. Quite a number of electric bells are used for highway crossing alarms. As the road is provided with electric block signals, these highway crossing alarms are kept in order. About 40 miles in one section have semaphore block signals operated by electricity, as well as the Hall signals at other points. A block signal system is maintained at each telegraph station, which is permissive in a few cases in clear weather and favorable conditions. Generally it is an absolute block. The switch targets for all mainline switches are elevated to about 12 feet high, so they are visible for a long distance and easily picked out.

The engines are kept very neat and clean all over. The passenger engines are furnished with Pyle National electric headlights, incandescent cab and signal lights, Boyer speed recorder, and a full Westinghouse equipment. All engines have brick arches, and the firing tools and arrangements are kept in good shape so the men can do good work. Doubleheaders on freight are the rule, with the second engine several cars back of the leading engine. The leading engine, of course, operates the brake.

Superintendent of Motive Power J. F. McCuen has been on the system so many years in the various capacities of road foreman of engines, master mechanic and superintendent of motive power, that he has a personal knowledge and acquaintance with all his men, and gives them great credit for the good work they have done, and compliments them by saying, "They are getting better all the time."

Eccentrics Not on Driving Axle.

It is not many years since the practice of locating the eccentrics on a forward axle while the main crank pins were in the wheels on an axle farther back was condemned as bad, as the motion of the valve could not be closely regulated to the stroke of the piston, when the eccentrics and main rods were not connected by the same axle.

The small engines of the Manhattan and Chicago elevated railways were commented on for this reason. Now, a great many ten-wheel engines are coupled up in that manner and give just as good service as the other way, with the advantage of allowing a wider firebox, as it can reach from one axle to the other, with no eccentric straps in the way. The Santa Fe Pacific have a large number of engines of this type, the Queen & Crescent and a number of others, and all give the best of results as far as can be seen. The only question of any account is, how will the steam distribution be affected when there is much lost motion in the connections between the two sets of wheels?

At the Rhode Island Locomotive Works.

Work at the Rhode Island Locomotive Works is progressing even better than might be expected after their long shutdown, and a recent visit found them busy in all departments. The boiler shop was particularly busy, and air hammers made music that means much work is being turned out. They are at work on engines for the Wabash and Big Four, and there are some boilers for the Erie under way.

Compounds are receiving due attention, and a new design of intercepting valve is to go in those now being built.

Brass hub liners are being used on some of the engines and are forced into place, bearing both in the hub of driver and on the axle. This method of holding is said to be very satisfactory, and loose liners are hardly known where this plan is used.

Ventilating Tunnels.

One of the most difficult problems that engineering has encountered has been the ventilating of long railroad tunnels. Immense sums of money have been spent at different times in trying to work out this problem, but it seems at last to have been successfully accomplished.

What is known as the Saccardo system of ventilating has been applied to the St. Gothard tunnel in Switzerland, which is 9¼ miles long, with entire success in removing the gases which have proved so annoying in the Hoosac and other long tunnels. The problem to be solved was to create a continuous current of air with a velocity of about 10 feet per second. The system employed to do this consists of appliances for forcing a large volume of air at high speed through an annular chamber which encircles the whole circumference of the tunnel at one end.

The appliances to do this were put in operation last March, and are doing the work very well at a small expense. At present a steam engine is employed to do the work, but arrangements are making to use electricity generated by one of the streams in the neighborhood of the tunnel. It seems to us that the system might be beneficially applied to the Hoosac and other long tunnels in the country. American travelers object so badly to the stifling gases in tunnels that it would pay railroad companies to go to considerable expense to keep air pure in these places.

A Great Scheme.

A visionary individual, who gives Chicago as his address, has sent us a long description of a railroad that is going to be nearly as wonderful as creation. We submit to our readers the following paragraphs from the circular:

"I have all of my plans formulated for a new electric railway system to be known as Bell's Consolidated Equalizing Multiple Pneumatic Electric Railway, and now have patents pending at Washington, D. C., for the same. This road is to be built according to the most scientific and modern plans of the twentieth century; road bed to be 10 feet 8½ inches gage, with endless rail overcoming the butt joint; rail to weigh 150 to 200 pounds to the yard.

"The object of my invention is to increase the weight of road bed and decrease the weight of rolling stock, not by any means building lighter cars than the present system of steam railroads. The electric railway cars are to be built of steel of the most modern and scientific plans of the present age. One passenger coach to constitute a train, weighing from 80 to 100 tons, carrying about 600 to 700 passengers; box cars to weigh about 40 tons, and flat cars to weigh about 30 tons; freight cars to carry about 200 tons dead freight per car, which will bring it down to a minimum. If necessary passenger

HOMER RAPIDS, ALASKA.

cars can attain a speed of 200 miles per hour, and make a schedule time of 135 miles per hour; freight cars to make about 150 miles per hour and make a schedule time of 100 miles per hour. This may will run a long period without renewal of oil, as the roller bearings nearly overcome all friction. Under these conditions long and continuous runs can be made, as it will not at any time be necessary to stop

SHOP YARDS OF WHITE PASS & YUKON RAILROAD, AT SKAGWAY.

or figure 8, which will give the right and left curves, also straight track-bridging double loop at crossing, bridge to be about 30 feet high, which will give me more than the maximum grade between the Atlantic and Pacific oceans. A train to run 3,000 miles on this double loop will make an elevation of 7,500 feet, which will be more than the maximum grade between the Atlantic and Pacific oceans, and will give me all there is to an ordinary steam railroad for a test of my project to prove that I can do what I claim. I will put a passenger train on this 12½-mile double loop and make a continuous run of 3,500 miles without making one stop, and make the run in less than 26 hours, and carry from 600 to 700 passengers on the run. And will also put a freight train on the same place and make a continuous run of 3,500 miles without making one stop, carrying from 6,000 to 12,000 tons of dead freight in one train, which will be equal to the tonnage of any ocean liner. This may look to be excessive, but it can be done, and not to exceed 240 tons to the 100 feet of train capacity of road bed. Some of our modern steam locomotives

PREPARING FOR A POT LATCH OR INDIAN DANCE.

look to be excessive speed, but under the above conditions it can be done with safety.

"The roller bearings that are to be used in the construction of the cars, which will haul 50 to 60 per cent. less draft for the propulsion of this new system. The cars on that score, as I have made provisions so that a car can run a long period with one oiling, and at the speed already described.

"To show my project of a new system of electrical railway, I contemplate building a short line in the shape of a double loop, weigh about 150 tons to 50 feet of road bed capacity, whereby you will readily see that our bridges will not have to be much heavier than the present steam railways, as we have no hammer blow of any reciprocating parts, as our system has a continuous rotary motion."

Writing for the Press.

If writing for publication choose first a good journal. A simple test for determining the relative value of publications is to search their files for information on a given subject; the difference is surprising. A paper which on casual examination appears to be replete with interesting matter, will, on making a search as indicated, often prove to contain but few of those facts that are of importance and which one really wants to know.

The contributors to technical journals may be roughly divided into a number of classes. The first class comprises those who, by original research or exceptional facilities for observation, have secured some facts, and if an investigation has been made to see what others have done along the same or similar lines, an acceptable and readable article is the result. If the author does not take the precaution to look up the literature on the subject, some critic will, and the outcome may be humiliating.

In the second class may be placed those who lack the opportunity for securing original data, and must take the facts of others, which are compared, sifted, and combined, and conclusions drawn. If the compiler is competent and does his work with care he deserves to rank with the original investigator.

Thirdly come men who have a hobby or a questionable patented device to exploit, and fourthly, those who write merely to fill space. The less said of these classes the better; let a young man be not of them.

If a young engineer is so situated that he can contribute to the technical press as a writer in either of what are here called the first two classes, it will be of distinct advantage to him to do so. He acquires the ability to express himself well; he learns to think straight (or he is quickly found out); he will become known to his future clients. The discussion which may arise on the subject will be at comparatively short range, because publication is not delayed for weeks or months; an inexperienced writer is given a better chance to consider any reply to questions and criticisms than is offered in oral debate at a society meeting; moreover, the men who take part in such discussions do so because they are interested in the subject. Lastly, the pecuniary reward is not to be despised.

As a preparation for his future work a young engineer cannot do better than to become a close reader of the current periodicals which have for their field his chosen profession. Let him follow the discussions and, if possible, take part in them; in order to do this with credit to himself, he must become familiar with the subject, and having once mastered it will easily recognize it when, after a period of eight or ten years, that same subject appears again, thinly disguised and heralded as something that is really new. Many questions have a way of reappearing at more or less regular intervals, so that the elders of the profession have met most of them more than once.—Daniel Royse, in the *Purdue Exponent.*

[To the above we would add: Write on one side of the paper, and write the words so legibly that there will be no difficulty in reading them.—Ed.]

Andrew Carnegie on George Westinghouse.

A reporter of the *Daily News*, of London, interviewed Andrew Carnegie on a proposal of the Westinghouse Electric & Manufacturing Company to build at Old Trafford, near Manchester, a duplicate of their great works near Pittsburgh. Mr. Carnegie said: "Mr. Westinghouse is too great a man to belong to any one nation. He is one of the great benefactors of mankind. But it is not loss what a friend gets, therefore I am glad he is going to build in Britain. Whether the Manchester establishment will be able to compete with the Pittsburgh one depends largely upon what the British workman will permit Mr. Westinghouse to do. If labor restricts the product of his wonderful machinery, if it is not as sober and steady as American labor, it is doubtful; but given free scope Mr. Westinghouse, I have no doubt, will make the Manchester works as powerful as he has made the Pittsburgh. The British works will have the very great advantage over the American of being near the customer. It is this fact, no doubt, that has induced Mr. Westinghouse to establish a plant in Manchester. It is pretty certain that British labor will be almost wholly employed. He may at first have to bring over a corps of his expert young managers—a class which does not exist in Great Britain, but which I expect the Birmingham University to furnish by and by. In my opinion, there is nothing more desirable for Britain than the object-lesson Mr. Westinghouse has in his power to give by managing his works in Manchester. I congratulate not only Manchester, but Britain, upon this peaceful industrial invasion. The two branches of our race will be benefited by strenuous rivalry."

Car Lighting.

The Julius Pintsch Company, of Berlin, has compiled a very interesting and comprehensive report, showing in detail all the cars equipped on each railway in the many countries of the world with the Pintsch system of car lighting, also the locomotives, gas buoys and beacons and gas works. This report indicates there are 90,890 cars, 3,650 locomotives and 892 gas buoys and beacons using the Pintsch systems, with 303 gas works to manufacture the gas required for the illumination of these equipments.

WHITE PASS & YUKON ENGINE AND ROUND HOUSE.

In the detailed report of the Julius Pintsch Company of cars lighted with the Pintsch system in England it is shown that the Midland Railway has 2,454 cars equipped with the Pintsch light, and operates 9 Pintsch gas works, and that the London, Brighton & South Coast Railway has 1,647 cars so equipped, and operates 5 Pintsch gas works. These two roads are specially interesting because they were the first lines in England to experiment with electric car lighting with the axle devices, and in 1890 had each from 400 to 500 cars equipped with the axle system of electric lighting. After the use of such a system for several years, they found it too expensive and uncertain to maintain. It is fair to conclude that neither of these railways would have abandoned the electric system after they had expended so much in its development, and adopted the Pintsch system, with the outlays in investment in equipments and so many gas plants, unless it had been most conclusively proved to their interest to do so.

General Correspondence.

All letters in this Department must have name of author attached.

Anonymous Correspondents.

In spite of the standing heading at the beginning of this department telling correspondents that every letter published must have the name of the writer signed to it, we continue every month to receive letters that do not agree with our rule. They all go into the waste basket. Some of the writers want to use a *nom de plume* while giving their right name; others send merely initials. We have been forced to adopt this rule for self-protection and we intend to adhere to it. We found to our sorrow that men sometimes made covered attacks on certain interests or individuals, and they were not willing to take the responsibility for what they had written, but had no objection to saddle the blame upon us. We got tired of that, for good and sufficient reasons, and now follow the policy of letting every writer carry his own burden.

Railroading in Mexico.

Under heading "The Hard Railroad Row in Mexico," it looks like waste of valuable space in such a valuable paper as LOCOMOTIVE ENGINEERING to publish such dreams of sensational escapes as narrated by Mr. McPherson. His knowledge of spelling Spanish is proof that he knows but little of Mexico or the laws which I have always found to be very just to foreigners. I send you clipping from *Mexican Herald* of this date, which is an illustration of how railroad men get in trouble. I have been running an engine for several years here in the interior, and have seen numerous cases where men have been in trouble for killing native Mexicans; but cannot say that I have ever seen a case where Americans have been badly treated. The district judge notifies the company, and such employés as are concerned appear before the judge and answer such questions as he asks, which invariably ends the case. Writing such sensational stories prevents honorable men from seeking employment in a country that is friendly to all foreigners. N. BARRETT.

Puebla, Mexico.

The following is the cutting referred to:

WHERE WINDS THE WHITE PASS & YUKON RAILWAY.

ENGINEER HENRY PIKE GETS ONE YEAR FOR HIS CARELESSNESS.

It will be remembered that on May 5th last a freight train of the Interoceanic Railroad, of which the engineer was Henry Pike, who was in a state of intoxication, instead of stopping as it ought to have done at the old station of San Lazaro, advanced to the passenger station and there collided with a passenger train which had just arrived from Puebla, and from which fortunately all the passengers had alighted. Nevertheless, the collision caused property damage estimated at $1,000.

Pike was arrested and placed at the disposal of the First District Court, but the conductor, Anderson, escaped. Pike has just been sentenced to one year's imprisonment for gross carelessness, whereby property was destroyed and human life endangered. Conductor Anderson has been exonerated from all blame, and the judge has sent a communication to the chief of police instructing him to suspend all further search for Anderson, on the supposition of his being still on Mexican territory.

It happened that on the very day the sentence was handed down, the court received a note from the Foreign Relations Department inquiring as to the status of the case for the information of U. S. Ambassador Clayton, who had interested himself on behalf of the imprisoned engineer. By way of answer Judge Perez de Leon transmitted to the department the closing portion of the sentence against Pike.

Pooling of Locomotives.

Having read from time to time the many articles occurring in LOCOMOTIVE ENGINEERING, I am prompted to give the readers of your valuable paper the results and experiences of a year's pooling of locomotives on one of the most prominent and progressive railroads in the West.

On this division we are using a class of ten-wheel Brooks engines, 18 x 24 inches, and these engines make 7,000 miles per month, rated at 700 tons, over a hilly division, with high boiler pressure and very bad water. We remove flues after six months and give the engine a few light repairs.

Engineers on arrival at terminal are expected to report all visible defects, pounds and blows. Engine is then taken in charge by competent inspector and thoroughly examined, oil cans and tools removed and headlight filled. Now, with engine on pit in roundhouse, the inspector inspects engine while she still has steam. He will start pump and examine all air pipes for leaky elbows and unions, mark all defective joints with chalk, to be repaired later; he will have brakes adjusted to insure equal piston travel both sides, and note condition of packing leather in brake cylinders on pull-up type of driver brake, will keep pistons well packed, and a little valve oil put in cylinders improves efficiency. The tender brake really doesn't get the attention its importance demands, but inspector should note piston travel, keep slack in brake beams well taken up, and see that shoes bear on wheel tread properly and that shoes fit head snug.

He will now drop under engine with hammer and torch; report condition of engine truck binders and cellar packing. By careful adjusting and close watching we use very little new packing and have very few hot journals. With the other system we rebabbited brasses nearly every trip.

Now inspector may drain main reservoir, and by paying close attention to spring hangers, bolts, springs and equalizers, delays on acount of break-downs are reduced to a minimum here.

Pedestal binders, links and eccentrics come under his observation next. Link block and saddle pins are examined, and it is noted that rocker-box bolts are not working.

Eccentrics may be tried with a light bar sometimes found loose on shaft; set screws, blade and strap bolts examined, and straps kept closed properly.

Inspector now examines condition of back boxes, draught rods, chafing iron,

ON THE WHITE PASS & YUKON RAILWAY.

etc.; inspects tank wheels for loose wheel-fit, chipped rim, sharp or vertical flange tread, worn wheel, etc.

We can now look around outside of engine. There should be a complete supply of tools kept in back tank boxes at all times, and same looked after every trip. On this road we keep boxes sealed with car seal, and when seal is found broken, are examined, and anything found missing is replaced before engine goes out.

A careful inspector should examine rods closely for loose bushings, loose on pin

ON THE WHITE PASS & YUKON RAILWAY.

and loose in rod, and report same; keep guides closed and cross-heads lined up properly. See that wrist pins are not out of round or loose in cross-head, and report keys or wedges in front ends of main rods lined down if necessary.

The whistle stem demands attention; joints should be kept tight.

Wedges and cellar packing are a very important part of the working of a pooled engine.

Wedges should be carefully adjusted by the inspector, and record of same kept; after once set where they belong will run easily twenty days or longer. On ten-wheel engines front wedges should be set up snug. On this road we jump main wheels, set wedge up tight and pull down 1-16 inch, back wedges ⅛ inch. In this way we have no stuck wedges and very few hot boxes. This road has had its share of hot boxes. But since the advent of the pool, these engines are running comparatively cool. And why? Because by using a form I have here, every engine and each individual driving box is watched and dealt with according to its needs.

After once getting engines in shape, an inspector with a good assistant can take care of wedges, cellar and cab packing. An engine can be thoroughly inspected in from thirty to forty-five minutes.

On this division we have twenty-five engines and thirty-five crews, and I venture to say engineers know one engine as well as another, and will do as much and as good work with any one of them as he would were he assigned to one regular. Engines here are making two trips to the single crew's one, and pulling every pound of freight possible. Engineers, instead of coming to the roundhouse to do dead-head work, get the rest they justly deserve with their families.

The inspector should be well posted on air brakes, injectors and lubricators, and be able to instruct enginemen. He should not try to be catchy, and not use his position to create discord and strife, and I am safe in saying engineers will praise instead of denounce the pooling of locomotives.

JAS. S. MARTIN.

Arkansas City, Kan.

Against Smoking in Y. M. C. A. Rooms.

My August LOCOMOTIVE ENGINEERING just received, and in looking it over I noticed an article on "The Use of Tobacco in Y. M. C. A. Rooms," in which the "goody-goody" rule of this association is attacked. It looks to me that the men who use tobacco could forego the pleasure of their cigar long enough to do what reading or loafing they would do at the Y. M. C. A. rooms. From the tone of the article, one would be led to believe that the only place to get a cigar would be in some saloon or gambling house, or that railroad men were especially prone to loaf at these places, could they not smoke in the Y. M. C. A. rooms. This is a mistake, as there are plenty of places where they may buy their cigar or do their loafing, without going to the saloons or gambling houses; and besides, the user of tobacco ought to be satisfied to smoke

on the streets and at his work, without pervading the atmosphere of every place with the odor of his cigar or pipe.

On the other hand, if the man who does not smoke wishes to enjoy a pleasant place to pass a leisure hour, he likes to do so where it is quiet and the air is pure. He could not very well do this if the air was so heavily laden with tobacco smoke that it could almost be "cut with a knife." If the practice of not allowing smoking in the Y. M. C. A. rooms is "narrow minded," then also is it narrow minded in those who use tobacco, and will not join the Y. M. C. A. simply because they may not be permitted to use their tobacco when in the association rooms. The percentage of railroad men who would refuse to join the Y. M. C. A. because they could not use tobacco in the reading and rest rooms is considerably smaller than that of those who do not use tobacco and would refuse to join were this practice permitted. In this case the man who does not use the tobacco is entitled to just as much consideration as the man who does, and has a right to demand that the air of the reading room should be pure and wholesome, which would not be the case were the indiscriminate use of tobacco permitted.

SAM. M. HUFFMAN.

In the August number of LOCOMOTIVE ENGINEERING, in an article headed "Favors Smoking in Christian Association Rooms," the writer says "which forbids the sale of cigars or tobacco in the Association rooms, *or the use of tobacco while in the rooms.*" The writer is in error concerning the underscored words. It is the rule, and not the exception, that railroad associations provide a room where the men may go and play games and smoke. Provision is made by placing cuspidors for the ones who chew tobacco. If the writer will take the trouble to drop a line to the International Committee, Y. M. C. A., 3 W. Twenty-ninth street, New York, he can verify my statement, and perhaps have a more kind feeling for the railroad association.

E. F. RIDEOUT,
Gen'l Sec'y R. R. Y. M. C. A.
Kenova, W. Va.

The Ton-mile per Hour Not a Piece-work Price.

BY GEORGE S. HODGINS.

The July number of LOCOMOTIVE ENGINEERING contains an explanation of the method of keeping fuel records on the Buffalo & Susquehanna Railroad. There is no need to comment on the system there set forth by Mr. J. H. Goodyear, the assistant general superintendent. It embraces features which must commend themselves to all.

It seems to the writer that the time element is in a certain sense used in that system. Fifty pounds of coal *per hour* is the standing-still allowance on the road, and 500 pounds *per hour* is counted as the switching equivalent. At the end of each trip, it appears, the conductor gives the time, i. e., the hours spent in standing at stations and the hours occupied in switching. These hours, translated into terms of coal at the rate given above, are subtracted from the total amount of coal burned, so that the amounts burned in actual haulage of trains are the important figures to be dealt with.

We have then x tons of coal used in moving a train of certain tonnage over such and such a distance in a known direction. But the same amount of coal may be burned in making the same ton-mileage in double the time of the first train, and this method does not have at its disposal any means of differentiating the performances. We have two engines doing the same work, but at different speeds.

If two men each do the same amount of work, one in half the time of the other, the faster man of the two is (other things being equal) the more valuable to his employers. If the men be paid day-work wages, the employer loses money on the slower man. If they be paid piece-work prices, the slower man makes less money than the faster man, and in ordinary language he would be said to lose on his work.

The faster man turns out more work. He does more work, he works harder than his fellow, because his time is less on each piece of work turned out. There is no gainsaying the fact that the faster man expends more physical energy than the other. His muscles move faster and his bodily power is expended more freely than that of his friend.

With engines the case is very much of an analogy. One engine hauls a definite weight over a given distance, and is paid, so to speak, in tons of coal. The second engine does the same work in slower time, but is paid the same price in coal. Putting the two side by side for one month, the output of the first engine is greater than the second. The first works harder and pulls more ultimate tons of freight in the month than the other. It is oftener on the road, or it has the chance to be. Rapidity of movement of competitive freight must redound to the advantage of the road maintaining the best speed. If you want freight moved, which engine would you choose? Manifestly the faster of the two. You would so choose because the second does more work. But each engine is only paid so much coal for so much ton-mileage, just as the faster workman was paid so much for each "piece" turned out. In the account books of the company the cost of each piece is exactly alike, whether A or B performed the work. With a piece-work price wherein is the faster man the better for his employer? He is better simply because he gives more "pieces" to sell and make money on than his co-worker. The faster engine gives more moved tons to collect revenue on in the month than the slower engine. The ton-mile cost in coal is equal, however, for each engine. One man works harder and gets more money. One engine works harder and burns more coal, but the price of each "piece" in one case and the ton-mile in the other do not vary.

One man's muscles move faster and he expends more energy than the other man. But it is not muscle or physical force that is being paid for, it is the "piece" of work. In the case of the engine, however, it is, so to speak, muscle or expenditure of energy that is really being paid for with coal, and not so many "pieces" turned out. The object of computing engine performance is to account for the coal burned, by the power exerted. To fairly pay the engine you must use some equation which will give an increase on the work side, when the coal side increases. An equation which takes note of the time used in doing work is the only correct, fair or admissible equation which will satisfy the known conditions. The ton-mile per hour is the "work" side of such an equation. If the engine gets as much coal for so many ton-miles, it is like paying the same price per piece to Mr. Slowman and Mr. Quickman. When locomotive performance is computed it is the energy or power, or, if you will permit the phrase, the physical exertion of the engine, which you wish to appraise.

Engines, if they could speak, would perhaps ask for the ton-mile per hour, and some of them might, in the words of the busy advertiser, see that they got no other.

A Correction.

I notice in the publication of an article, "A Talk with the Fireman," on page 353, month of August issue, near the close of the article referring to firemen using six and eight shovelfuls to a fire, "I recommend a reduction of 5 per cent." This should have been 50 per cent.

W. J. TORRANCE.
Evansville, Ind.

Action of Driving Wheels in Passing Curves.

Having read an article in the January issue of your publication regarding the slipping of driving wheels on engines, I desire you, if possible, to throw some light on a subject which has been the cause of much controversy. Does either outside or inside driving wheel slip when an engine is going around a curve?

The outside track around a curve is naturally longer than the inside track, therefore the driving wheel on the outside track travels over more space than the driving wheel on the inside track in

the same length of time. If either one of the wheels slip, both of them being solidly attached to the same axle, how can we account for the difference in the distance that each travels? If convenient, kindly reply in your next issue.

Danville, Va. J. J. Phaer.

[Those who have investigated this subject say that the wheels inside of the curve revolve with a slipping action, as they have to turn as often as the outside wheels, which are traveling a longer distance.—Ed.]

Diseases of the Monitor Injector.

A few words about the care of the Monitor injector, which is in use almost everywhere, may help some of the boys; and the diseases in practical service are what we want to learn about. It should be kept well packed. Rope asbestos and graphite are good.

Suppose the injector has been working well, and suddenly it will refuse to prime when you want to start it; you can look for trouble in the lifting nozzle, No. 18b, which has probably come out. But in that case the noise of steam escaping from the overflow would not have the same noise; instead of having the jet-like whistle, it would have a roar and could readily be detected as having no drawing power. (Of course it is assumed that tank valve and strainer are all right.) The trouble could also be with valve No. 34, called heater cock check. Screwing the stem No. 36 up and down will probably loosen it. If the water gets low in the tank and injector does not prime readily, lifting nozzle 18b should be renewed.

If valve 13 on end of stem 14 should come off, you could not keep injector from priming except by shutting off valve 19, which would still let the steam blow out of lifting nozzle 18b; and in order to stop that, it would be necessary to shut off steam at the globe valve in steam pipe at boiler.

In order to work an injector in that condition till you get to repair shop, it would be necessary to open valve 19, then turn on steam, which will prime injector; then open valve 8, which will put the water into the boiler; but it will also let steam come out of lifting nozzle 18b and overflow, as long as injector is kept working. You could take off bonnet 15 and fish out valve 13 with a wire, and replace or leave it out entirely.

If valve 8 fastened to stem 9 comes off, and you had to use that injector, you could take out yoke 4 and fish out the disk with a wire and replace it. You might possibly be able to leave it off and screw the end of stem 9 up into steam nozzle 25, so you could get in with it. It would probably cost a new steam nozzle, which is cheaper than killing an engine, and probably laying out an important train.

You will sometimes find the nut comes off of valve 8 or valve 13 and the pressure of steam hold the valve to the seat, but in that case you could tell by the ease with which the valve worked that the stem was not bringing the valve back with it.

You will sometimes find an injector, after priming and opening steam valve 8, that will still keep throwing out the water on the ground, but with greater velocity. In that case reducing the water supply by closing valve 19 will force water into the boiler.

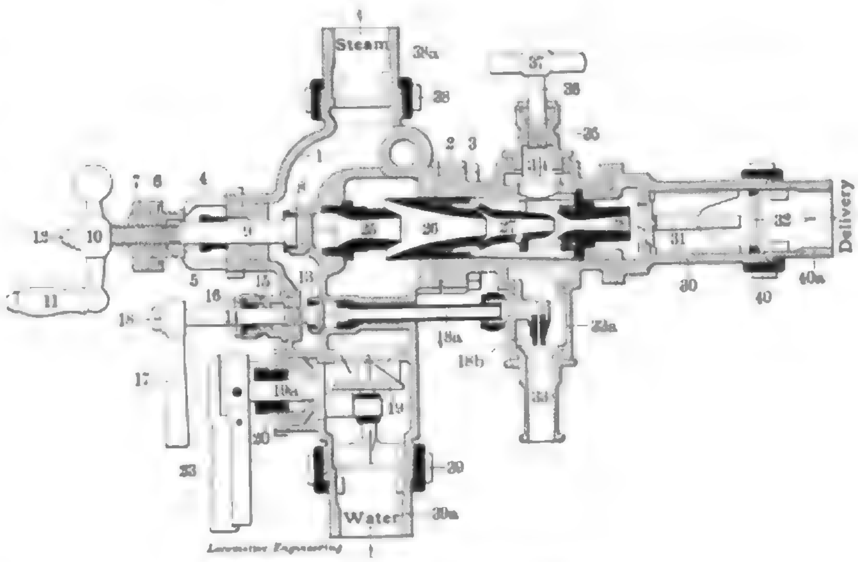
Now suppose the end of eccentric spindle 19a, where it goes through valve 19, was to break off and the weight of valve would not keep the valve open, you could take off water valve bonnet 20 and put a wire above valve between wings of valve to keep it from closing.

Suppose a valve is leaking; it is one of two places—either valve 8 or valve 13. To determine which, put injector at work. If the steam continues to blow out of overflow, report "Primer valve leaking"; if it stops when injector is working, report "Steam valve leaking." Don't report overflow ground in, or you will have the foreman or machinist hunting you up to explain how it works, in order to know what to do.

Then there is another way of reporting an injector failure, which I will call a "blanket report," which consists in reporting "Overhaul injector," which gives a machinist no insight into the defect; and if the engine is wanted immediately, it makes the foreman wrathy, after dissecting the injector, to find out all it needed was a "liming out." You are all familiar with the trick of closing steam valve and pouring water on an injector to cool it off in order to prime it.

A. A. Lindley.

Oskaloosa, Iowa.



DISEASES OF MONITOR INJECTOR.

Tire Wear of Locomotive.

It must be conceded, even by those who lay just claims to a thorough knowledge of the construction and operation of the locomotive, that there are some effects of service, the causes of which are not by any means generally known. With no correct theory to guide, they will continue to exist, and the usual results will naturally follow; when, if the true causes were known, partial preventives or remedies might be employed, that would materially reduce the damaging effects that are productive of no little annoyance and expense.

The writer can confidently state that if there has been anything yet published that pointed out all the true causes of irregular tire wear, or to be more definite, the flat spot in the tire of locomotive driving wheels, it has escaped his notice. The opinion prevails that the counterbalance is responsible for it, and the unvarying regularity with which the flat spots appear on the same part of tire had possibly a tendency to confirm that erratic belief, since the position of the counterbalance is always the same with relation to other parts, including the part showing excessive wear.

It must be admitted that the counterbalance, by reason of the varying pressures on rail due to its presence in the wheel, together with the effect of the steam action—that is, the push and pull of the power imparted through the medium of the more or less angular main rod, do both tend in no small measure to produce uneven wear of tire. The influence of the former is greatest when the engine is slipped; that of the latter is dependent on the cylinder pressure and cut-off.

Driving wheels are provided with bal-

ance weights, to counteract as near as possible, the otherwise irregular effect of weight of crank pin, rods and that of the reciprocating parts, such as piston and crosshead, to produce smooth running and smooth riding when the engine is worked normally; that is, without slipping. Under that condition the forces of rotation and translation developed in the locomotive driving wheel are duly proportioned, and although there is no known fixed proportion of weights that will perfectly balance each other at widely different speeds, a fair degree of perfection is attained by aiming to balance with regard for the service the engine is to be used in. Under the foregoing conditions the irregularity of wear would be trifling, but when the engine is "slipped," all is changed. Then the forces of rotation and translation are disproportionate to each other. With the excess of rotative action is developed an abnormal degree of centrifugal force within the driving wheel, that was before somewhat modified by the opposing influence of its translative action, and, owing to the fact of the wheel resting on the rail below, and supporting a weight on axle above, the centrifugal force is not free to exert its influence equally in all directions, as in the case of a flywheel, and the irregular action produced is evidenced in the irregularity of wear of tire of all locomotive driving wheels, either main or trailing wheels, in proportion consistent with the conditions above stated.

But there is another, a more pronounced evidence of irregular wear of tire, to which it is the purpose of the writer to call attention, and which prompted the writing of this article. It is the "flat spot" that may be found on the main driving wheels of all engines that have been in service for some considerable time, is more pronounced on the left than on the right main wheel, and in a degree depending on the following conditions: The nature of the service, the fitness for the service, and the manner in which the engine is run while performing the same. We will first see what causes the defect, then can we the better understand the influence of the conditions cited above.

With the right engine the leading one, we find the largest "flat spot" on the left main wheel, at the point in contact with the rail when the left main pin has just passed the forward center. We find it also in a lesser degree on the right main wheel at a point on the tire in contact with the rail a trifle later in the revolution than that on the left wheel, that is, it begins later, but ends at the same time, being shorter, and not so deep.

The same cause that makes the excessive pound in the left main driving box on a right lead engine going forward, and in the right main driving box going backward, is just what causes the flat spot in both main tires, and to which latter may be justly charged the damaging effect to track that is usually attributed to other causes.

In the May issue of LOCOMOTIVE ENGINEERING may be found an article which explains why engines pound most on the left side, and assuming that the reader has read that article, we will proceed to learn what relation the excessive pound in driving box and excessive wear of tire on left side bear to each other.

When the pound takes place just after the pin has passed the forward center, the driving box, which is forward against the shoe when steam is admitted to forward end of cylinder, is forced back against the wedge, and as the box is forced in the opposite direction to that in which the engine is moving, the driving wheel must necessarily slide to accommodate the change of position of the driving box, and it is this slide, which occurs as regularly as the wheel goes round when the engine is working hard, that, like the proverbial drop of water falling on the rock, wears the tire flat on the point in contact with the rail when the slide takes place.

When the wedge stops the backward movement of the box, the "slide" of the wheel is checked, and so suddenly that the wheel usually slips a little, which effect is, of course, immediately communicated to the right main wheel, and which slip causes the flat spot in the tire of right main wheel. The least observant engineer has, no doubt, noticed that an engine will, when pulling hard, slip when the right main pin has just passed the lower quarter, sometimes just a little at each revolution, and if "she lets go" altogether will almost invariably "fly up" when the pin is at that point.

Here can be seen how the development of the flat spot may be influenced by the nature of the service, for when the engine must be worked to full capacity almost continually, the slide is produced once in each revolution, while if the engine could be run with a light throttle and still do the service required, the slide might not take place owing to the reduced cylinder pressure, and if the pressure was still enough to cause the slide, the slip that would follow in the case of the full throttle would not follow it in the use of the light throttle.

Now we come to the question of fitness of engine for service. In the foregoing lines we have seen the effect of such proportion of engine as necessitates working to her full capacity, and yet if the engine performs the service satisfactorily we must concede her fitness for the service. We must now inquire into her condition, and the most important question is, How are the main driving boxes? Are they "solid?" If they are, especially the left one, the flat spot will be very much less than when the left box is loosely fitted on the axle, or loose by reason of neglect, or ill-fitted shoe or wedge.

The manner in which the engine is run is entitled to some consideration here, and it has perhaps as much influence on the irregularity of tire wear as any other feature relating to the subject. With engines of same size doing an equal amount of work, say in the passenger service, where the time and weight of trains are nearly uniform, even there may be found a difference due to the different practice of the engineers. One forces the engine to attain the maximum train speed quickly; the other gains speed slowly, but necessarily attains a higher maximum speed. The former practice will produce the most irregular tire wear. It may be possible that under the conditions just cited, where the weight of trains and requirements of speed are similar, that the difference due to different practice would not be shown to any appreciable extent, but when we apply that theory to the handling of freight trains, with practically no restriction as to speed, and a rather indefinite one as to weight of train, the effect of trying to beat "express time" with a big freight train will show itself plainly in the uneven wear of the tire, due in some measure to the greater tendency to slip when forcing the train quickly into the maximum speed, and partly for the reason that the slide on left side is greatest under these conditions, whereas it would be somewhat modified after getting under good headway if the engine was worked lightly enough to maintain a fair speed.

Knowing the causes of the defect is one thing, knowing a remedy for same is another. We cannot dispense with counterbalance, it being necessary to insure the smooth riding of the engine. It would be of no use to change from a right lead to a left lead engine, as we would merely change the defects to oposite sides. We must have engineers with sufficient dash in them to suit the requirements of the transportation department.

We can fit up the main driving boxes so as to make them solid, thereby reducing the slide to the minimum. We can equip with air sanders that will almost wholly prevent slipping. Yet, in spite of all this, the flat spots will show themselves, though in a much lesser degree than under contrary conditions. The only resource left, then, if a remedy is desired, is to shift the tire around on the wheel, bringing a good surface to bear on the rail at the point where the flat spot was developed, by which makeshift we wear a new "flat spot," while the old one will grow no greater, if no less. That the shifting of tire is not more generally practiced can only be attributed to the failure to understand the benefit resulting from it. There can be no reasonable objection, when the facts relating to it are taken into consideration, and the saving that would result would be by no means trifling, if the effect on rail, bridges and permanent way be

considered, aside from the waste of tire, which latter is by no means the least source of expense that burdens a railroad company.

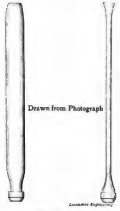
THOS. P. WHELAN.

Bellevue, O.

Collapsed Dry Pipe.

Your April issue contains a brief article describing the flattened condition of a dry pipe that had been taken from engine 316 on the Illinois Central road, which was remarkably effective. In this particular line of mishaps these peculiar actions of dry pipes in locomotive boilers are rare; but the Interoceanic road at this point had a similar experience with switching engine No. 11, carrying 140 pounds of steam, the pipe being 3-16 inch copper, 3¼ inches diameter and 6 feet long, with heavy brass joint fittings. The enclosed sketch will show how complete was the collapse, with the exception that it left ⅞-inch opening on both edges which were formed by the pipe closing vertically in its original position.

On examination it was found that this condition had existed for some time prior to the engine being taken out of service, and, absurd as it may seem, she had



COLLAPSED DRY PIPE.

been doing her usual amount of yard work, and no complaints had ever been made of any inefficacy by those having her in charge. She was only taken in the shop when necessary for general repairs.

J. J. PRICE.

Puebla, Mexico.

A Novel Stop Block for Engine Houses.

In the Chicago roundhouses of the Illinois Central Railroad a piece of ⅝-inch cable chain, 4 feet long, is used for a stop-block to keep the engines from moving on the pits. The chain is laid over the rail in a loop around the driving wheel, with the ends hanging down in the pit. The chain is drawn up close to the flange on each side and held there by the weight of the free ends hanging down. When the chain is not in use, it is hung on one of the posts of the house.

Trials of this chain blocking have been repeatedly made, and it has been found impossible to run an engine over it with full pressure of steam. If blocks of wood are used, they are very apt to slip or work to one side and let the engine get away.

Novel Hydraulic Press.

The accompanying engraving shows a hydraulic jack press which was designed by General Foreman R. D. Gibbons, of the Santa Fé road at Las Vegas. We are

NOVEL HYDRAULIC PRESS.

using it for rod and driving-box work, and it has given good service for over a year. Most of the old screw press now decorates the scrap pile, and we wonder how we got along without this as long as we did. The columns are made of cast iron extension piston rod casings. The arch is the top of the old screw press. A 30-ton jack is hung from the top by a swivel plate bolted to arch, the barrel of the jack being held by the two rods shown and a weight which is connected to rods by rope. One man now does the work which took six or seven with the old screw press. Hope this will be of interest as it is easily made in any shop.

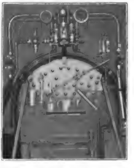
LEW D. WEBB.

East Las Vegas, N. M.

Conveniently Arranged Cab.

I herewith inclose you a photograph of cab equipment on engine 7, of Green Bay & Western Railway, just turned out of shop by W. P. Raidler, master mechanic, which I consider very convenient in every respect to what I have seen. In front of engineer's air brake valve and just back is connected with reservoir pipe a valve for air blow off cock. On side of boiler Sellers' improved 7½ injector; close to injector is a valve for air bell ringer and sander; air lubricator is in plain view; air gage in place where engineer can see. By side glance from seat steam gage can be seen, which is back of lubricator. Lubricator stands far enough in front to be seen by engineer and fireman. On left steam heat gage and governor, also No. 7 Ohio injector.

The photo will explain for itself as to



CONVENIENTLY ARRANGED CAB.

convenience. All engines in for general repairs are to be equipped the same.

J. C. WIGMAN.

Green Bay, Wis.

The curious and well-known by-product of zinc, chloride or salts of zinc, which formerly went to waste, is now being largely used as a wood preservative by railroads, bridge builders, dock builders, and for the protection of shingles, clapboards and any other wood that is exposed to moisture or influences productive of decay; the salts of zinc, in solution, by means of hydraulic pressure are forced into the pores of the wood, which is then soaked in a solution of tannin and glue. An important fact in this connection is that the ties and piling now used on the Santa Fé & Southern Pacific, and some other Western roads, are treated in this manner, the companies named using annually the large amount of three million to four million pounds each. The singular fact is also stated that, with this simple treatment, a pine tree—which is the only kind that can be found out in the mountain country—will last three times as long as one of oak.

In describing the fine new ten-wheelers for the New York Central Railroad on page 362 of our August number, we omitted to mention that they were built by the Schenectady Locomotive Works. A similar omission happened with front and rear views of the locomotives built by the Schenectady Locomotive Works for the Midland Railway of England.

Locomotive Engineering

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The Low Water Scapegoat.

It is amazing the dense ignorance that some men are capable of displaying on subjects they are supposed to be familiar with when the extent of their knowledge is gauged publicly on a witness-stand. A few months ago the writer sat for several days in a court-room and heard master mechanics and so-called boiler experts testifying concerning what might have been the cause of a certain boiler explosion. They were called as experts for the defence, and appeared to think that part of their duty was to exonerate their employers from blame, and in trying to do so made ridiculous statements that proved they knew nothing about the elementary principles of mechanics or of the forces that contribute, under certain circumstances, to tear the sheets of a boiler into fragments.

The suit was for damages for loss of life due to the explosion of a locomotive boiler, and defence, as usual, was that the disaster was caused by the carelessness of the engineer in permitting the water to get too low, exposing the crown-sheet of the firebox, thereby leading to sudden rupture. The firebox crown-sheet, which was in the court-room, did not show any evidence of having been burned, or even scorched; but the "experts" employed by the company swore that low water was the apparent cause of the accident, and that no other cause was likely to produce a boiler explosion.

The plaintiffs held that the boiler was in defective condition, as had been reported in the roundhouse books; that the outside sheets of the firebox were badly corroded, and that the initial rupture began there. One of the humbug "experts" on being asked what was likely to happen if a rupture of a weakened sheet opened, answered that the only effect would be to relieve the pressure. Perhaps he knew that a sudden release of pressure would tend to make the latent heat in the water flash into steam and act like an exploded charge of dynamite. We are inclined to think that he did not know this, and so gave the jury the benefit of his ignorance to inflict injustice.

"Low water" is a convenient scape-goat for the sins of bad boiler-making and for criminal neglect of inspection. Corroded plates, broken staybolts, defective joints and butchered boiler work are the real causes of boiler explosions; but when a suit for damages is instituted, the low-water scape-goat is always trotted out, and it seldom fails to be efficacious with a non-technical jury and shrewd lawyers, aided by experts whose ignorance of boiler construction makes them testify just what the lawyers desire to put before the jury.

The locomotive boiler is subjected to the hardest kind of usage, carries extremely high pressure, is difficult of access, and has flat surfaces that the pressure constantly tends to distort. Under these circumstances unsleeping care and vigilance are necessary to prevent accidents, and we are sorry to say that on some roads gross carelessness exists about the inspection of locomotive boilers. Periodical examination of staybolts ought to be made, and on well-managed roads this duty is very carefully attended to, but on others inspection is almost a farce. The practice is, to depend upon the staybolts remaining good enough to hold the sheets together until the engine goes in for a general repair. That is inviting disaster, and it comes occasionally, but not so frequently as might be expected. We recently heard particulars of a case where a new master mechanic took charge and found out that there had been no inspection of boilers made until the engines went into the back shop. He lost no time in having a thorough inspection made, and found that all the engines had broken staybolts, varying from 17 to over 200.

In a report made to the Railway Master Mechanics' Association, one sentence reads: "Explosions originate from overpressure; it matters not whether the whole boiler or a portion of it is too weak to resist the pressure."

Too few men responsible for the safety of locomotive boilers realize the tremendous forces confined within the shell of a steam boiler. In one of his works, Professor Thurston gives an impressive lesson on the forces confined in a boiler. He says: The boiler here taken was designed by the author. It is 30 inches in diameter, 30 feet long, and is rated at 10 horsepower. The boiler weighs a little over a ton, and contains more than twice its weight in water. The water, at a temperature corresponding to steam at 100 pounds pressure, contains over 46,600,000 foot-pounds of available explosive energy, while the steam, which has but one-fifth of one per cent. of the weight of the water, stores about 700,000 foot-pounds, giving a total of 47,000,000 pounds, nearly, or sufficient to raise 1 pound 10,000 miles. This is sufficient to throw the boiler 19,000 feet high.

Freight Experience Before Promotion.

That is a point connected with the success of every promoted fireman when he begins work as an engineer which does not always get the attention which it deserves from the officers and firemen. The case often comes up of a man who has fired on a passenger train for a number of years previous to his promotion, and who considers that he needs no more freight experience as a preparation for service as a freight engineer.

If the line of promotion was from fireman to passenger engineer direct, it would not make so much difference, but it is never that way. The promoted man generally has a long and arduous service on freight ahead of him, and his education and experience should be such as to fit him for success as a freight man, right from the first trip as an engineer. He should be familiar with every grade and curve, both on the main line and on the sidings or in yards, and thus know how to work the engine and handle the train so it will always be under his control, both in starting and stopping. For the promoted man to gain this knowledge in a practical way it is necessary to see how freight trains are handled under all conditions of weather and rail with the varying grades, together with the location of the fixed signals which govern the movements of his train, as seen from the freight tracks in yards.

The passenger work is of such an entirely different character that in a good many cases it crowds the ideas he gained of the freight work at the beginning of his service as a fireman to one side, and when he goes on freight it is like a new trade altogether.

On a passenger train the engineer is usually a man who handles the train himself at all times, and depends on the other man to attend to the fireman's duties strictly; while on freight there is more latitude allowed, so that the fireman gets

a better chance to accustom himself to the work. Passenger trains usually get the good engines, which are not expected to break down, and what is left on freight service will give a fireman a better idea of how and when he may expect to find the troubles incident to disabled engines and cars. Then the freight engines usually are harder to manage, in operation, in oiling around, in inspection and keeping in order. His observation and familiarity with the details of their construction are absolutely necessary when one of them is disabled, in order to get under way as soon as possible, and not block the main tracks.

The young engineer on a freight engine does not always get the regular man on the engine to help him out. More often he has a spare fireman, with little or no experience, so that it is not only necessary to attend to all the engineer's work, but also supervise that of the fireman. This is a full-sized job for an experienced man, let alone the beginner.

For these reasons—and still others may be stated—we think it very essential that men about to be promoted should "learn the road on freight," and unless they have recently been changed from main-line freight work to passenger service, at least six months on freight engines on the different divisions should be required before promotion. Of course, the old passenger firemen will not all agree with this opinion, as some of them look at it as a step backwards to leave a passenger run and fire an old freight engine; but they can better learn how to get along by seeing how some one else does it.

Investigation on your own road of promoted men who have had repeated failures as freight engineers will usually show that they have little service as freight firemen. Think of this point, boys.

Electric Locomotives.

It is not such a long time ago that we used to hear that the steam engine for drawing railway trains on our first-class roads would soon be a back number, and the electric locomotive would take its place. When the switching motor at Baltimore proved that it could handle the heaviest trains the Baltimore & Ohio sent through the tunnel, it was the foundation for more conjectures as to the time limit for the steam locomotive to disappear.

There are several points to look out for before this great change takes place. In the first place, the steam plant for handling trains is now installed and doing good service, and while we are the most progressive nation on this globe, yet our progress is not radical enough to throw away the steam equipment and spend two or three times as much money to install the electric appliances. Most companies will take the conservative side and let well enough alone.

Then the cost of the stationary engines, boilers and dynamos for furnishing as much power as the locomotives now develop will be a sum vastly in excess of what it costs to produce it with locomotives.

For instance: Suppose that the regular freight engines develop 800 horse-power, which is a low estimate. Lots of big switch engines are 'way above that, and it is nothing unusual to see eight or ten of them at work in one yard besides the main line engines pulling out and in. Ten 800 horse-power engines will call for 8,000 horse-power at that one place, which is a large plant, as power houses are now.

Then there is another trouble. When the snow is drifted and gets packed hard on the rail, so the wheels do not get a good contact to pass the current through, it will stop the whole business. The observation of railroad men watching a snow blockade on a street railroad will teach them that the steam locomotive can do better in a Northern snow-storm than the electric motor. Steam can get its power or current to the rail somehow.

There is no doubt that an electric motor can produce a rotary motion of the drivers at a higher speed than the reciprocating steam engine, and it has no dead center or no limit to the speed at which the drivers can revolve, provided there is electric current furnished to do the work; but till some means are found to produce the current more cheaply, carry it from place to place with less danger to both life and inanimate bodies, and do the heavy work now performed by the immense freight locomotives in everyday service on nearly all the railroads of America, we need not fear that steam locomotives will be out of commission.

For the continuous service which we have on street railways, elevated and surface, it has distanced steam. The competition in this line has brought up the question of substitution of electricity for steam again.

So far, no very close figures of the relative cost of electricity and steam for hauling our heavy traffic have been submitted. A practical trial will show this, and until that is made, the steam locomotive engineer and fireman can rest easy, and go right along striving to perfect themselves in their special calling, confident that there will be a market for their skill at a fair price for a good many years yet.

A Brick Lined Firebox.

Many engineers interested in the development of the locomotive engine have insisted that, from an economical standpoint, the weak feature of the engine is the firebox. The form of the firebox is awkward for applying the strengthening elements needed to prevent the flat surfaces from being torn apart by the steam pressure inside; but to some men the worst part of the firebox is that the heated sheets being surrounded by water, the heat of the fuel gases is absorbed so rapidly that some portion of them is constantly kept below the igniting temperature, and therefore passes into the tubes without doing heating service. It has been rationally argued that if the high initial temperature of the fire could be maintained until the fuel gases reached the tubes, there would be a greater proportion of the heat utilized for steam making.

This subject has been repeatedly discussed in railroad associations, in railroad clubs and by the engineering press of America, and the remedies proposed were generally that the firebox should be made of firebrick or other refractory material; but the demand for the change has never been strong on this continent to induce any railroad company to experiment with a fire-brick firebox. We believe there were some experiments made with freak locomotives long ago, that had partly fire-brick fireboxes, but they did not prove the soundness or fallacy of the principle.

On the continent of Europe certain railway companies have displayed more enterprise in this direction than our people have done. Several railways in Germany tried locomotives with brick fireboxes, but the results were not satisfactory, because the intense heat generated burned out the tubes or passed out of them at a ruinously high temperature. This may, however, have been due to faults in the design of the boilers. A boiler having about the same length of tube as those used with a water-surrounded firebox could not be expected to give good results with a firebox that did not abstract any of the heat from the fire.

There has been in service for the last five years on the Belgian State Railways a locomotive which has what is called the Docteur brick firebox. The engine was designed for express train service to pull a train of 560,000 pounds on a fairly level road at a speed of 50 miles per hour. The driving wheels are 78 inches diameter, and the cylinders placed inside the frames are about 18 x 24 inches. The total length of the boiler is 23.12 feet, the firebox being 118 inches long, and the tubes being a little over 13 feet in length. The diameter of the boiler at the smallest ring is 59 inches, and contains 277 brass tubes, about 1¾ inches diameter. The grate area is 35.5, and the brick lining is about 2½ inches thick, made with air cooling passages opening above the level of the grate, the whole of the air required for combustion being drawn through these passages and raised to a temperature which makes it really a hot-air-fed furnace. The total heating surface is about 1,400 square feet, all of it being in the tubes.

In other respects the engine does not depart from the usual eight-wheel Belgian express engines. A somewhat inferior grade of coal is used, but it is re-

ported to give an evaporation efficiency of from 8 to 9 pounds of water to the pound of coal. The lining of the firebox is reported to be quite durable, the first one having lasted since it was put in.

The experiment has been so much of a success that our enterprising railroad companies ought to try it, especially in the districts where coal is expensive.

Making Electricity Direct From Coal.

Seeing an electric current employed to heat hair curling tongs has moved a writer in a Boston paper to indulge in prophecies about the great future in store for the electric current and the innumerable ways in which it is destined to promote the comfort and convenience of mankind. Electricity has already made great progress into the domestic circle, and there it is probably only in its infancy. The same may be said about the machine shop and the engine house. Electricity is destined to do great things in the transmission of power and light; but people who wax enthusiastic about the numerous purposes for which electricity may prove more convenient than direct heat, should not forget that electricity is not in itself a motive power.

In the semi-scientific articles written for Sunday papers we are frequently seeing dissertations on what will happen when the discovery is made of how to convert the potential energy of coal or of any other combustible directly into electricity. It is a long time since scientists discovered that electricity was generated by the combustion of zinc, and this no doubt gave the suggestion as to the possibility of using fire or other forms of heat for making electricity, and many of the most powerful minds in the world have worked on the problem of converting heat into electricity without the intervention of steam or heat engines, but their labors have been entirely fruitless. A few years ago the announcement was made that the revolutionary problem of converting heat into electricity had been solved, but when thoroughly investigated the electricity-making furnace turned out to be nothing more than an ingenious battery.

The nearest approach to the generating of electricity by heat is in the thermopile, the principle of which was discovered many years ago by a scientist named Seebeck. The discovery was that when a circuit composed of two different metals soldered together has one of its junctions heated, an electric current will be produced. Instruments made on this principle have been greatly used for scientific investigations, and have demonstrated certain valuable facts about heat and physics, but it does not seem capable of being used on a large scale.

In spite of the multitude of failures to obtain electricity cheaply as a direct product of carbon or other substance the belief is widespread among sanguine thinkers that the thing will be worked out some day. The sanguine temperament and the imagination that can conceive the tremendous industrial revolution that would flow from the full energy of coal being utilized in making electricity direct, assumes that it must come about, and in the absence of telling how it will be done prophecies are made in a vague way that it must be done. That does not bring the act any nearer realization. There have been many scientific problems of a highly desirable nature that never make any progress. It has seemed very desirable that transportation should be carried on in the air, where there would be no rail wear or wheel friction to oppose movement, but every effort in that direction has proved futile, and there are obstacles to success not likely ever to be overcome. There seems to be nothing that the genius of man wrestles with which is absolutely impossible, but the making of electricity direct from coal and the guiding of vessels through the air are engineering triumphs not yet in sight.

The Misfortune of Growing Old.

"Young men for war and old men for council" is an ancient aphorism based on the experience of ages. It seems to us that in America the leaders in nearly all lines of business are adopting a policy entirely the opposite to what long experience has proved to be the safest and best, for the rule of the day appears to be: Discharge all old men except presidents, and put young men in their places. It used to be the case that a man was valued for the experience gained in his business, but nowadays when a man is beginning to get ripe in experience he is liable to be pushed aside as worthless. There are some men so constituted that they cling with blind fidelity to the practices of their youth, and who oppose advancement and progress as dangerous innovations. Men of that peculiarity are not fitted by nature to direct or manage any kind of work; but men with these characteristics are comparatively rare, and progressive old men should not be punished for those whose minds become fossilized long before the infirmities of age overtake them.

The tendency to discharge employés and officials because they are getting old is common to every department of business, and for the last few years it has been inflicting cruel blows upon railroad men. "We must keep up to date," is the battle-cry of the men who lead this movement, and an idea frequently based on a fallacy is offered to justify hardships inflicted and to defend a policy which is frequently vicious, expensive and the opposite to progressive. Railroad operating and railroad management have been learned by a tentative process in which trial, test and experience indicated the best method, the best forms and the safest practices. The high success achieved has to a great extent been built upon failures. The most valuable capital of experience consists frequently in the knowledge of things that will not work and methods that will end in failure. Yet to-day the men who are richest in this kind of capital are no longer in demand by railroad companies. While the discussion on engineers wearing spectacles was going on in our columns, the manager of a big railroad system wrote taking the stand that railroad companies ought not to be deprived of the services of experienced engineers if aid to the eyesight would protract their time of service. That displayed sound judgment, for the old engineer had already passed through the course of mistakes which are avoided only by the teaching of practical experience. The same reasoning applies to nearly all departments of business, and it applies with greater force as we rise up the ladder of position. Master mechanics, superintendents and others have been a long time learning the pitfalls to avoid in carrying on their responsible duties. The recollection of past mistakes has intensified their vision for the detection of fallacies and lines of weakness; yet as soon as an official of that training attains a mature age and gets out of a position through the everlasting changes in railroad life, it is practically impossible to find new employment. To all inquiries he is told, "We prefer younger men." That really means, in many cases, that we prefer the capacity for making more blunders than the experienced man would make; and what is frequently a good, efficient, faithful official is at the end of his usefulness because it has become the fashion to employ young men.

Autobiography of a Locomotive.

"Ajax Loquitor, or The Autobiography of an Old Locomotive Engine," by Robert Weatherburn, M. I. M. E., is a book of 150 pages, 5 x 8 inches, recently published by Crosby, Lockwood & Son, London. It is supposed to be a locomotive giving its own autobiography, but it also contains a great deal of sensible talk about the design and handling of locomotives. Nearly every important part of the engine becomes the subject of description and philosophic reflections. One of the best divisions relates to engine drivers, and the author proves that he is quite familiar with the idiosyncrasies of that class of men. Here is a fair specimen out of that part: "Bob was a quiet experimentalist in his way, and often tried my patience by not letting well alone. I have known him to have five or six of his notions at work on me at one time; but his good humor and sunny disposition more than reconciled me. The only shadow in his path was old Nixon, the works foreman, who, in the spirit of his class, would insist that he knew the engine and what was needed better than Steel. Intuitively I knew when they had met to disagree by the

bustling way in which Steel mounted the footplate, and would commence humming his favorite tune of 'Scots wha ha'e;' but the bellicose fit never lasted long, and when the tune was changed for 'Old Dog Tray' I felt more contented, knowing that he was himself again.

"Their greatest contentions were respecting the proper weight of my driving wheels and the set and lap of valves. Nixon used to make occasional alterations without letting the other know; and in order to detect any such aggressions Bob used to make wire gages of the position of the axle-boxes and valve-spindles to his own liking, and should any serious discrepancy be found after repairs, he would insist that Ajax was Ajax no longer. I must say that he was generally in the right, although oblivious to conditions.

"One of his choicest fads was a good model of my valves and ports, by which he would logically prove, to his own satisfaction, and to the bemuddling of others, that with the absence of internal lap I was not nearly as good as I should be, owing to the steam getting away too early; and, much to my chagrin, he at length persuaded our engineer to fit me with valves with a quarter of an inch internal lap, promising that he would then conclusively prove the advantage. The result was a severe blow to our joint prestige; for how we blundered through that miserable journey I could never tell, and my old friend left me that night for the first time very much disappointed and indeed miserable. Nevertheless, many of his schemes were really good, and his career as a driver justified the high opinion in which he was universally held.

"He was full of specifics. As a consequence of his success and reputation as a good driver he was considered a great authority, and was often consulted by his mates on matters pertaining to the management of engines. Wise and often mysterious in his replies, like all oracles, he frequently left his clients in doubt as to his true meaning. But this I have noticed as a peculiarity of men of far greater pretensions than Bob Steel. When wishful to be *very* impressive he rhymed, but without madness."

Performance of Fast Trains in Europe.

We have had on our book table for several months a very handsomely illustrated book, written in French, by Camille Barbey, a well-known Swiss engineer and railroad manager. The title is "Le Service Actuel des Trains Rapides," and it tells about many journeys on fast railway trains in different European countries. Not only are the weight and speed of different trains on all the leading railways in Europe carefully given, but there are exhaustive descriptions of all kinds of railway machinery, locomotives and cars receiving most attention. Mr. Barbey is evidently a firm believer in compound locomotives, and thinks that the four-cylinder type most thoroughly meets the requirements of train service. He, however, discusses the merits and shortcomings of the two-cylinder type and favors the arrangements by which two-cylinder compounds may be changed to work simple at the will of the engineer.

People who interest themselves in fast trains will find this book a thoroughly reliable reference, for it is entirely up to date for trains outside of the United States. The illustrations comprise locomotives, cars, trains in motion, stations and signals. The express locomotives and trains in the British Isles receive the lion's share of attention. The book concludes: "Now we conclude our studies by wishing again to the steam locomotive a long and brilliant life, and that it will not be frightened by the electric locomotives more or less problematic for the future."

BOOK NOTICE.

Compound Engines. By James Tribe, Racine, Wis. Price $1.50.

Most books on this subject are large in size, heavy in composition and have enough calculus and algebra to frighten anyone but a student fresh from college. This, on the contrary, is a small hand or pocket book, with round corners, red edges and bound in flexible leather, making it just the book for the busy man. It is divided into fifteen sections, and seems to contain about all the practical points in which an engineer is interested, while the clear manner in which the author explains his meanings and works out examples of the various cases makes it a valuable addition to any engineer's library. Although stationary engines are dealt with, the laws of expansion are the same in all classes of engines, and the points brought out are of interest to all engineers. Air pumps, injection water and condensing apparatus generally are discussed, and examples worked out so that any engineer can see how the different problems are calculated. The best ratios of cylinders for various conditions are treated in a rational manner and can be relied on, as Mr. Tribe is an authority on this subject. Best of all, they can be done with the ordinary rules of arithmetic.

Here is a new way of holding your seat on a train when you have occasion to leave it. The other morning a traveling man of Arkansas City got on the train and was walking through looking for a seat, when he discovered one which to all appearances was unoccupied. He went to it, and imagine his surprise when he saw a six-shooter calmly resting on the cushion. He passed on and found a seat in another part of the car. He says that people came in and started for that seat, but as soon as they saw what it contained, marched on. Try it some time.

Warming up in the South.

EDITORIAL CORRESPONDENCE.

In the early part of July, when the earth was getting roasted in the Northern States, I found myself one evening comfortably seated in the "Vestibule Limited" train which leaves Chicago at 5.45 P. M. on the Illinois Central, and goes direct to New Orleans. The distance is about the same as that from New York to Chicago, and is made in about twenty-four hours. All the railroads running between the Eastern States and Chicago are noted for the beautiful scenery they pass through, but the trip from Chicago to New Orleans presents attractions that are not seen by those who travel from East to West or who follow within three or four degrees' variation of latitude. In going from Chicago to New Orleans the traveler goes over about twelve degrees of latitude, and it takes him from the temperate almost into the tropical zone. The physical features of the route are no less attractive than those witnessed in an East to West journey, and there are found the additional attractions of seeing the variations of vegetation and forest growth from the rugged forms that spring to life after the rigors of a semi-arctic winter and of those that bask all the year in the joys of unfrosted sunshine.

After dinner in the democratic air of the smoking room, while we were rushing over the far-stretching emerald prairies of Illinois at the rate of sixty miles an hour without jar or jolt, I got into conversation with a gentleman, and we naturally talked about the splendid condition of the railroad we were riding upon and the great future prosperity in store for the company. My new-made acquaintance was very enthusiastic about the advantages which a good North and South road possessed over one running from East to West, which was something new to me; for it used to be generally admitted that North and South roads made small earnings compared with those that carried the crops of the West to the Atlantic seaboard and brought merchandise back to pay for the crops.

The gentleman quickly displayed wonderful knowledge of all the transportation problems on this continent. He said the Illinois Central has more to haul both ways than any of the east and west roads. "You will see as you go along," he remarked, "that they are carrying all kinds of Northern farm products, Northern merchandise and coal South, and the return trains are loaded up with the products of the South. They are hauling North vegetables and fruit and lumber and a great variety of other Southern products." My informant's information proved correct, and he proved to be a good authority on many other matters, for he was no less a personage than General Sooy Smith, the famous civil engineer who built the first steel bridge of any con-

sequence, and proved to the world that steel was a good material for bridge construction. We sat and talked railroading, engineering and other congenial topics until nearly 2 o'clock in the morning, and I never spent a more interesting night.

When daylight appeared we were in Tennessee, getting towards Memphis, which was my temporary destination. In the night we had jumped from the prairies of Illinois, with the long-stretching fields of corn, the prosperous-looking farmhouses surrounded by orchards and wide pastures filled with live stock, varied by fields of small grains, into a land where the field products would look new and strange to those who had not seen them before. We were in the land of cotton, or rather over the entrance to it. For a time patches of cotton were alternated by bigger patches of corn; but as we proceeded the cotton began to get the best of it. There is a wise saying, "Never put all your eggs into one basket," which applies very forcibly to farmers with their crops. There has been a tendency among the farmers of the South, especially, to devote their attention to one kind of crop, and when that failed they were destitute. During this trip through the South I noticed much greater diversity of crops everywhere South of the thirty-eighth parallel of latitude than I had ever seen before.

The trip over the Illinois Central from the Ohio river to New Orleans leads the traveler through a wonderfully interesting country, both in general diversity of scenery and in details. Now we are spinning through heavily-wooded lands, with here and there small clearings, where cotton and corn and sweet potatoes are seen growing in stump-dotted fields. Then there are lakes and rivers and morasses, to be followed by fine valleys of cultivated farms that evidently have been the "plantations" of other days. The general tendency is towards rolling woodlands, but in some sections the scenery is quite mountainous, with glens and gorges producing contrasts of shade and color that few regions can equal. Other districts are almost as flat as middle Illinois.

To people who know the growth personages in the woods and fields, the trip to the South is an unceasing source of wonder and delight. Looking at trees, one leaves behind the oak and "the ash and the bonny elm tree," as the Scotch song goes, and added to them the maple, the hickory, the poplar and different pines, may be said to form the Northern tree world. I did not miss any of the old friends among the thickets and groves of the South, but renewed acquaintance with others we seldom see in the North—trees that love heat and moisture to bring out their smiling glories. First among these beauties was the magnolia, which has no objection to the plebeian shrubs and parasites that densify the Southern forests, and then came the live oak, an aristocratic member of the tree family, which does not entirely refuse to mingle its shadows with the sassafras, the cypress and the tamarac. There were others that I had never been formally introduced to, unless it be the yellow pine, and so I shall not attempt to tell how much they contributed to the beauty of these vari-colored woodlands. If an artist could do justice to the wealth and variety of coloring that these denizens of the forests present to the naked eye, he would make a series of pictures such as the art world has never seen.

As we approached Memphis we passed through numerous "truck" farms, where the market products are raised that give Chicago the finest selection of vegetables and fruits of any city in the world. It looked as if eight or ten acres of well cultivated land were sufficient to keep a large family in comfort. While looking at the numerous small patches of land that gave comfort and prosperity to every family working on them, I acknowledged the truth of a remark made by General Smith, that the South could provide comfortable homes for the whole pauper population of the North if they could only be induced to embrace the opportunities always open to them.

I have been in Memphis several times, always in summer, and it has never struck me as a town to hie to when the temperature in the North is climbing towards the 100° mark. This time I landed on July 4, and a very short stay convinced me that Greenland's icy mountains would have been more comfortable. However, I went to the various railroad engine houses, and generally found that the friends I was in search of were celebrating Independence Day. In the afternoon my old friend R. H. Briggs, master mechanic of the Kansas City, Memphis & Birmingham, past president of the Master Mechanics' Association, called upon me at the Hotel Guyon, with his son, and while we were visiting together a neighboring building took fire and spread the flames to the hotel, which was soon burned down. I took my experience in the fire as a warm welcome to the South.

My progress from Memphis involved a series of stoppages at every place where the Illinois Central had division shops. The particulars of what I saw must lie over for another letter. But here I must say that on every division I found that the company were carrying out betterments and improvements on the property that will make the Illinois Central Railroad an ideal line for the transportation of freight and passengers safely and expeditiously at low cost. I have been aware from personal connection that the company for eight or nine years have had stone crushers at work preparing rock ballasting, and I know that these crusher plants are now laboring to meet the demands of the engineering department for this kind of ballast. It seemed that on every division work was going on in the reduction of grades, on the straightening of the track, and on the doubling of track where press of business demands it. They are also extending sidings and putting in automatic station signals where these aids to the prompt and safe movement of trains are necessary.

In "The American Railroad Manual" for 1873 I find the remarks: "The Illinois Central Railroad is one, which, by its conservative management, has done perhaps more to raise the standard of American securities in the financial centers of Europe than any railroad company in this country." That was twenty-seven years ago, but the same conservative policy has been maintained, and a spirit of enlightened enterprise has been added to it of late years, which promises to make the Illinois Central one of the best railroad properties in the world. A. S.

Engine Numbers.

On one of the prominent trunk lines there is a move being made to remove the large numbers now placed on the sides of tenders and send them out plain, so they can be changed from one engine to another when necessary without painting out the old numbers and inserting new ones.

While this is a move in the line of interchangeability and economy, yet there is another point to consider, which is of some importance to trainmen where the number of the engine is used to identify the train. The number on the engine is usually small, so that the large number on the tender is used to identify the train in the case of meeting orders, etc.; it can be accurately made out both at a distance or when passing at full speed. Engine numbers should be made very plain, so there will be no possibility of a mistake.

At night the headlight numbers must be carefully looked after just as the engine passes.

On systems where the trains have specific numbers independent of the engine numbers, and these train numbers are carried on a bar in front of headlight glass, it does not matter very much whether the engine numbers are very clearly seen when passing, but where this practice of numbering trains is not followed the engine numbers should be very plain, as a safety precaution.

The Ingersoll-Sergeant Drill Company have recently sent out their revised Compressor Catalogue No. 33. It is a beautifully illustrated book of 105 pages, and contains a great deal of useful information on the flow of air through pipes and a variety of formulæ and details which will be found very useful by the operative engineer. Anyone interested in air compressors will find this book a very convenient assistant. We understand that the catalogue will be sent free to people interested in air compressors.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(84) L. C. M., Conneaut, O., writes:

Will my letter on "Help Engineers to Find Employment" be published? A.—No. We do not publish anonymous letters.

(85) R. Y. B., Cleveland, writes:

How does the capacity for labor of a healthy grown man compare to that of a horse? A.—An ordinary horse is capable of raising about 22,000 pounds one foot per minute. A strong man can raise about 4,500 pounds one foot per minute, or its equivalent. So the man has power about one-fifth that of a horse.

(86) J. S., Scranton, Pa., writes:

1. What is the relative bulk of bituminous and of anthracite coal? A.—1. Bituminous coal weighs about 52 pounds per cubic foot; anthracite weighs about 54 pounds for the same bulk. 2. What is the cubic measure of a ton of bituminous coal? A.—2. A ton (2,000 pounds) of bituminous coal fills about 40 cubic feet.

(87) J. T., Kingston, New Zealand, writes:

Can a valve of a locomotive have both inside lap and inside lead at the same time? A.—No. There is really no such thing as inside lead. If the valve is cut away so that release begins before the valve reaches the middle of the seat, it is called inside clearance. Of course it accelerates the exhaust period, and on that account may be called lead.

(88) J. L. L., Harrisburg, Pa., writes:

Will you kindly tell me the number of pounds a consolidation locomotive will pull on a level track, with cylinders 20 x 24 inches, driving wheels 50 inches diameter, boiler pressure 130 pounds? Also please give simplest rule for calculating same. A.—You will find a formula for calculating the power of locomotives in the January number of LOCOMOTIVE ENGINEERING, this year, and you will find it in Sinclair's "Locomotive Engine Running and Management."

(89) Inquirer, Detroit, Mich., writes:

We were discussing questions that were likely to be asked by the train master, and a dispute arose on the question, What is a time card? One party held that it was a schedule made to regulate the movement of trains, but a lot of other definitions were given. What do you call it? A.—A time card is a list of stations and the time at which trains should arrive and depart. It also defines the rights of certain trains, and contains rules for the movement of trains.

(90) S. C. C., Hartford, Conn., writes:

I have had a little dispute with a friend of mine about the motion of the eccentric and the crank. He claims that the two motions are different, the eccentric giving a faster motion than the crank, at a certain point. In other words, that if eccentric and crank (both having same throw) are connected to and work the same object as a valve, the object will bind at a certain point. I claim that the motion is exactly the same at all points, and that the object will not bind. Can you kindly settle the dispute? A.—You are right. The motion of crank and eccentric are exactly the same.

(91) R. A., Providence, R. I., writes:

In reading scientific papers I have frequently met with the expressions "unit of heat and unit of work." Now, I know that unit is a measured quantity, such as a pound of butter, but I do not see how it is applied in the way mentioned. If you will explain the thing to me in LOCOMOTIVE ENGINEERING, you will help out others besides myself. A.—1. A unit of heat is the amount of heat required to raise the temperature of water one degree Fahr. at what is called its greatest density, which is just above the freezing point. This is often called the British thermal unit, and is equal, when converted into mechanical work, to the energy required to raise one pound weight 772 feet. 2. A unit of work is one pound raised one foot. The most common way of measuring work is by the horse-power. One horse-power is estimated as 33,000 pounds lifted one foot per minute.

Flint & Pere Marquette Moguls.

The Flint & Pere Marquette Railroad have lately received five large mogul engines from the Brooks Locomotive Works which have some novel features that are a departure from the ordinary standards. The cylinders are 18 inches bore, and have an unusually long stroke, 30 inches, which Master Mechanic Hatswell expects will give better results in freight service than a shorter stroke. Piston valves are used which admit the live steam from between the heads of the valve. The valve seat, or, properly speaking, the bore of the steam chest, is part of the cylinder and half saddle. This steam chest is not over the cylinder, but at an angle, and just over the frame. The rocker boxes and rocker arms are inside the frame, so that the valve rod is inside of the forward drivers instead of outside of them. This allows a proper length for the eccentric blades. The two eccentrics for each side of the engine are cast together and finished up that way. The wheel centers are of cast steel, 50 inches in diameter; all tires flanged. A single long spring extends from one forward driving box to the other, resting on top of the driving boxes. The equalizer going to the pony truck is hung to the middle of this spring, so that the spring acts as a cross equalizer.

The boiler is of the Belpaire type, sets on top of the frame, extends over the rear driving axle, carries 180 pounds of steam, has the J. Snowden Bell extension front end, and is supplied with two Ohio injectors. The engine deck is about a foot above the level of the tender frame and bottom of the water tank. The water space runs clear across, so there is a water bottom under the coal space in the tender as well as at the sides. The tender carries 4,500 gallons of water and 8 tons of coal.

These engines weigh about 135,000 pounds, exclusive of tender. They have a tractive force of 26,556 pounds at 85 per cent. of the boiler pressure for full stroke.

They are used in heavy freight service, and giving excellent results. The accounts of work done by engines on this railroad are kept in ton-miles, so that it is an easy matter to know just what they are doing. They show a considerable saving for fuel and wages over the 18 x 24 moguls in the same service. The Flint & Pere Marquette officials are very proud of the record they are making.

Sale of Life Insurance at Railroad Ticket Offices.

His train left the Jersey side at 7.25 P. M., but he hurried across the ferry to make sure of getting a sleeping-car berth. "Lower to Cleveland, please," he said, as he presented himself at the ticket office window. "Pullman tickets on sale in half an hour—at 7 o'clock. Move on, please," curtly replied the tallow-faced, insipid hireling inside, with a lordly air. The traveler grumblingly obeyed, walked seventy-nine laps around the waiting room, read all the signs many times over, "rubber-necked" all the periodicals at the news-stand, leaned wearily on his umbrella, endeavoring to kill time, and meanwhile grew madder and madder at the clerk in the ticket office. Seven o'clock came and went. Likewise 7.05, 7.10 and 7.15. At last the window was raised, and the traveler joined the now good-sized mob of crowding persons, each anxious to get tickets and aboard the train. The traveler managed to get an upper berth in a crowded car. "Insurance, sir?" cringingly whined the now servile lordling; "$5,000 insurance for 25 cents?" "No! you sniveling, tallow-faced presumption!" exclaimed the thoroughly irate traveler. "I want none of your blankety-blank-blank insurance! It's bad enough to have to patronize your blankety-blank rotten road, let alone being reminded that it's necessary to take out life insurance every time you travel over it!"

Fast mail train No. 8 on the Chicago, Burlington & Quincy Railroad left Mendota, Ill., on June 28th 40 minutes late, and ran to Riverside, a distance of 72 miles, in 62 minutes, or at the rate of 69.67 miles per hour. The train was hauled by one of the Burlington's class "P" Baldwin locomotives, No. 1591, with Engineer Dove at the throttle.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Leverage of the Locomotive Driving Wheel—Why the Locomotive Moves.

A correspondent writes as follows:

"Please explain why a locomotive moves. It may be simple enough to any-one who knows; but there are several of us mixed up on it. What I mean is, how is the power applied to the wheels during an entire revolution?

"Take a locomotive when the pin is on the bottom quarter, going ahead. What are the points of the lever in the wheel? Is the fulcrum at the center of the axle, at the crank-pin, or the point of contact with the rail?

"It is easy enough to understand a stationary engine. The front and back cylinder-heads form the resistance for the steam to push the piston; but when you consider a locomotive when the main pin is on the bottom quarter, going ahead, it seems to several of us that the piston

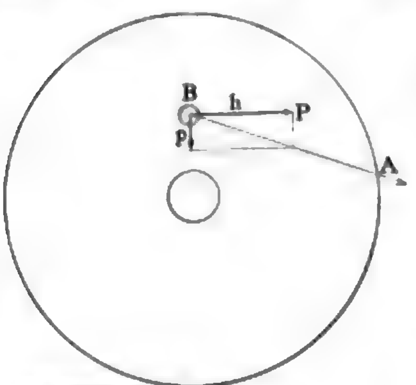


Fig. 1

LEVERAGE OF THE DRIVING WHEEL.

forms the resistance and the front cylinder-head pulls the locomotive along. That would change the point, on the driving wheel, at which the power is applied."

In reply to the inquiry of our correspondent we would say that the problem is one that may be better presented by a graphical illustration and somewhat lengthy treatment. For simplicity we will confine our observations to one side only of the engine.

Fig. 1 shows the direction of the force applied by the main rod A on the pin B. As we are concerned only with horizontal forces in the movement of the locomotive along the track, we can resolve, by the law of parallelogram of forces, this oblique or angular force exerted by the main rod into perpendicular and horizontal forces p and h respectively. As p is of no value in this problem we will omit it, and retain only the horizontal force h, which will henceforth be known as P, the actual horizontal pressure exerted on the pin by the main rod. Thus we will avoid all entanglements with, and need make no further reference to, the angularity of the main rod in dealing with this problem.

Fig. 2 shows the driving wheel acted upon by P, the force at the pin, P_1, the driving-box resistance, and P_2, the force at the point of contact between the wheel and rail. The arrows indicate the direction the forces are acting, viz.: P and P_2 are forward and P_1 is backward. Thus we have a lever of the second class, whose arms are respectively 12 and 30 inches, and which is fulcrumed at P_2. The force exerted on the pin, we will say, is 10,000 pounds. Now we know the two lever arms and the force P, and will proceed to find the two unknown forces, P_1 and P_2. At the instant before the wheel starts to revolve there is an equilibrium of forces about the fulcrum point, P_2; *i. e.*, force P multiplied by its lever arm (the distance between P and P_2, which is 42 inches) is balanced by the opposing force P, multiplied by its lever arm (the distance between P_1 and P_2, which is 30 inches).

This we will state by the equation

$$P_1 \times 30 = P \times 42,$$ or

substituting the known value of P, which is 10,000 pounds, we have

$$P_1 \times 30 = 10{,}000 \times 42,$$ or,

multiplying together the terms in the right-hand side of the equation, we have

$$P_1 \times 30 = 420{,}000.$$

Now, P_1 is an unknown quantity, but we can find its value, for we know, as the equation states, that 30 times P_1 is equal to 420,000. Therefore P_1 itself must be equal to one-thirtieth of 420,000, which is 14,000. Now, as we know that the value of P_1 is 14,000 and of P is 10,000, we will put the figures instead of the letters in the equation:

$$P_1 \times 30 = P \times 42.$$

and we will have

$$14{,}000 \times 30 = 10{,}000 \times 42,$$ or

performing the multiplication, we have

$$420{,}000 = 420{,}000.$$

Thus equilibrium is proved.

Now that equilibrium of the forces has been proved, what have we accomplished that is useful? The answer to this question is that we have a proof that at the instant before the wheel begins to revolve the forward acting force of 10,000 pounds on the pin at the upper end of the lever just balances the backward acting force of 14,000 pounds on the axle at the middle point of the lever. Now, that this is proved, another step can be made. We will add enough more steam pressure to the piston to increase the force on the pin to, say, 10,001, instead of the even 10,000 as before. Now equilibrium is broken (for 10,001 times the lever arm, 42, equals 420,042, and is greater than 14,000 times 30 inches, which equals 420,000), and the lever will start to rotate about its fulcrum, P_2, and move in the direction of the greater force, which is to the right. Thus the wheel begins to roll to the right, and the engine moves forward.

Let us return for a moment to the lever held in equilibrium, as shown in Fig. 2, for we have not yet found the value of P_2, the adhesion between the wheel and the rail. To find the value of P_2, we will assume the fulcrum (during this part of the computation) to be at P, the pin. This assumption gives a forward force of P_2 multiplied by a lever arm of 42 inches balancing a backward force, P, multiplied by a lever arm of 12 inches. Putting this in the form of an equation, we have:

$$P_2 \times 42 = P_1 \times 12.$$

But P_1 has a value of 14,000 pounds, as

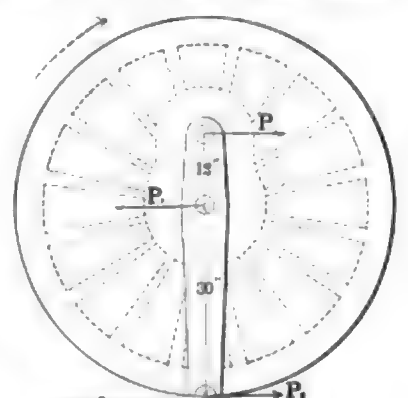


Fig. 2

LEVERAGE OF THE DRIVING WHEEL.

proved. Putting this in, we have the equation

$$P_2 \times 42 = 14{,}000 \times 12,$$ or,

$$P_2 \times 42 = 168{,}000.$$

We do not know the value of P_2, but we do know, as the equation states, that 42 times P_2 is equal to 168,000 pounds. Hence P_2 must be the one forty-second part of 168,000 pounds, which is 4,000 pounds. To prove this, and also to prove our right to assume the fulcrum to be at the pin during this part of the computation, the forces directed forward must balance those directed backward, *i. e.*, $P + P_2$ must equal P_1, or $10{,}000 + 4{,}000 = 14{,}000$. This is done, and is therefore proved.

We will now rotate the wheel ahead one half-revolution, as shown in Fig. 3, which places the pin on the lower quarter. This gives us a lever of the third class, where the force P is applied at the middle point of the lever and the fulcrum is still

at the point of contact between the wheel and the rail. Again, at the instant before the wheel starts to revolve and the lever to rotate about the fulcrum P_2, the forces are in equilibrium; *i. e.*, the forces pointing to the left multiplied by their lever arm must equal those pointing to the right multiplied by their lever arm. Putting this in the form of an equation, we have:

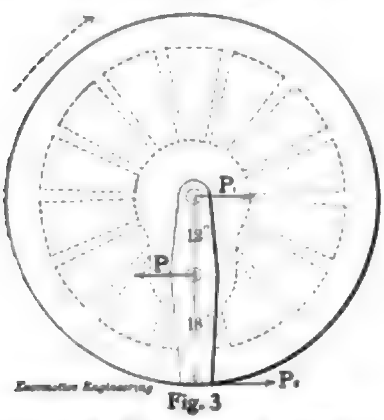
$$P_1 \times 30 = P \times 18.$$

As the pressure at the pin is the same on the lower quarter as on the upper, we can replace the letter P in the equation with 10,000 pounds, thus:

$$P_1 \times 30 = 10{,}000 \times 18, \text{ or,}$$
$$P_1 \times 30 = 180{,}000.$$

If 30 times P_1 is equal to 180,000 pounds, as the equation states, then P_1 itself is equal to one-thirtieth of 180,000 pounds, which is 6,000 pounds. Therefore P_1 equals 6,000 pounds.

Now that we know both the forces P and P_1, we can easily determine P_2; for $P_1 + P_2$ together oppose and hold P in equilibrium. Hence P_2 is the difference between 10,000 pounds and 6,000 pounds



LEVERAGE OF THE DRIVING WHEEL.

(P and P_1), or 4,000 pounds. Thus it will be seen that the forces on the pin and the rail above the centers are the same as those on the pin and rail below the centers. One notable difference, however, is the pressure of the axle in the driving box, which is greater while the pin travels through the half-revolution above the centers than that below. This is true whether the engine be running forward or backward.

Thus we learn that while the pin travels through the upper half-revolution, we have a lever of the second class, which gives the same pressure on the pin and pull on the rail as that had during the revolution through the under half, when the lever is of the third class. The progress of the engine through space should, therefore, be uniform.

Beginning at the back center, as the engine moves ahead one half-revolution of the driving wheels, the cylinders, frames and other fixed parts of the locomotive move forward through space a distance equal to one-half the circumference of the driving wheels, which is equal to one-half the diameter of the wheel multiplied by 3.1416 (30 × 3.1416), or 94¼ inches. During this half-revolution the piston pulls away from the back cylinder head, and, with the second-class leverage in the wheel, pulls the locomotive along. The absolute travel of the piston through space is therefore 94¼ inches plus 24 inches (the stroke), or 118¼ inches.

As the wheel completes the revolution, moving the pin from the forward center through the lower half-revolution to the back center, the fixed parts of the locomotive move through 94¼ inches more space, making 188½ inches in all. The piston, through this half-revolution, now loses 24 inches, and travels, therefore, but 70¼ inches forward. Through this half of the revolution the piston forms the resistance, moving forward more slowly than the cylinder head, which pulls ahead while the piston forms the resistance. The pressure on the piston through the lower half-revolution is exerted on the third-class leverage in the wheel.

The only times during the revolution that the piston stands absolutely at rest (in relation with the ground) is at the two dead centers.

Lubricator Connection.

Mr. C. B. Conger writes of air pump lubrication as follows:

A good many 9½-inch pumps use more oil from the lubricator to the steam than the area of the rubbing surfaces and the work done by the pump should require.

In many cases the drip cock at the pipe connection from the governor to the pump leaks more or less—principally more—the weight of the handle is liable to work it open at a time when it is not noticed by the engineer. The joints at the governor are not always tight, and with a governor that has been in service a long time it is not unusual to see oil escaping at the vent hole in the body of the governor cylinder.

Now, if the oil is taken directly to the steam chest on the top of the pump, and discharged on top of the slide valve, the pump will have a chance to use every drop of oil fed to it.

The Norfolk & Western Railway have made a trial of this plan, with very good results; other roads are also following this plan. Where a triple feed lubricator is used the oil pipe can be coupled direct to the steam chest of the pump, as this style of lubricator is fed by direct boiler pressure the feed will not vary any when the governor shuts off the supply of steam from the pump.

We would not advise that the small separate lubricators which feed the oil into their own steam supply pipe be coupled to the pumps direct, as they are liable to siphon out some of the oil when the governor shuts off the steam supply.

The Air-Brake Association Proceedings for 1899 are selling rapidly. Order at once. Don't wait.

CORRESPONDENCE.

Lubrication of 9½-inch Air Pump.

Editor:

In the August number of LOCOMOTIVE ENGINEERING complaint is made as to the difficulty of the 9½-inch air pump receiving proper lubrication, referring, no doubt, when the oil is delivered from a sight-feed lubricator into the steam pipe to air pump.

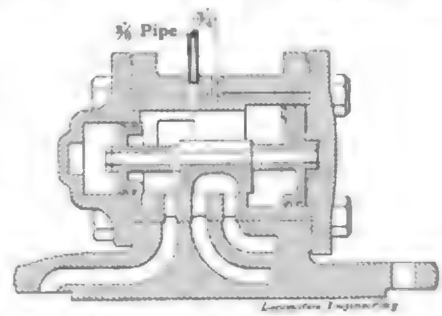
Some time ago this same question was up with us, and in our effort to improve the lubrication of the pump the lubricator was connected as shown in the accompanying print, the pipe entering through top of main valve bush No. 75. This pipe is located in the same manner as are the oil pipes to cylinders, the pipe from the lubricator passing under the jacket and coming out right behind the pump.

I know of some good reasons why this method should give good results, and would be glad to know if there is any objection that can be brought up against it.

J. R. ALEXANDER,

Altoona, Pa. A. B. Inspr., P. R. R.

[Several recent experiments have been made with this method of oiling the 9½-



PROPOSED METHOD OF ATTACHING OIL PIPE TO 9½-INCH PUMP.

inch air pump, and improved results have been reported from all. We know of no reason why this plan should be objected to.—Ed.]

Emergency Application Recorder.

Editor:

I send you herewith blueprint of the automatic emergency recorder. It is a device that will record on the dial each time the air brakes are set by an emergency application. It will not make any record whatever of service application. I therefore consider it to be a very useful addition to the present air-brake equipment, as it will aid those in charge to definitely locate the responsibility for flat wheels, both under locomotives and cars; also damage to draft rigging from rough handling, and will prompt enginemen to make an effort to handle their trains by making service applications instead of using the emergency as a majority of them do now. The principal details of the entire machine were worked out by my mechanical engineer, Mr. G. W. Wildin, we handling the matter jointly.

W. E. SYMONS,

Supt. M. P., Plant System.

Savannah, Ga.

Wrong Location of the Semaphore Air Gage.

Editor:

While air gages on locomotives are of as great importance as is the steam gage, still there seems to arise in the minds of some the failure to realize the fact of its importance. With the present various types of locomotives air gages have been located in many different places. Especially is this true on locomotives with very large boilers. The gage is, as a rule, placed with the group of other gages, very high up on top of the boiler, where in broad daylight it is almost impossible to read them. However, it has been practically demonstrated that much better braking and smoother handling of trains can be had when the air gage is placed in a position where it can be seen by the engineer at all times.

At the Nashville convention of the Air Brake Association this subject was reported upon in a very able manner, the committee deeming it advisable to place the air gage to the right of the steam gage, also at a convenient height, where the engineer could read it correctly without turning or stretching too much from his position. Another very important point was a make or style of gage that would prevent a shadow from the gage pointer, due to the light striking upon the dial, which would make it impossible to correctly read the figures. However, we are glad to say that within a short time after this meeting a patent was granted to Messrs. F. M. Nellis and S. D. Hutchins on a gage (just what was wanted) called the "Semaphore" Duplex air gage, a complete description of it appearing in February, 1898, number of LOCOMOTIVE ENGINEERING.

RIGHT WAY

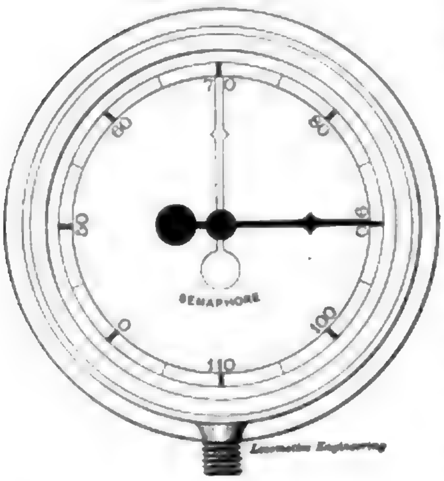


Fig.1

SETTING OF THE "SEMAPHORE" GAGE.

One of the principal and many good features of this gage is the dial, which is black with white figures. The object sought for was to afford a means of a plainer and more accurate reading of the gage to the engineer at all times, which can be done in less time by far with the new "Semaphore" gage than the old one, as the working pressure numerals of 50, 70 and 90 pounds were not always located in the same place; consequently the engineer had to divert his eyes from the track for some length of time, in order to try and read it correctly. The location sometimes is such that it offers a good excuse for wheel sliding by improper pressure being carried, and poor braking results in many cases from its poor location.

The new "Semaphore" gage is arranged on the bracket in such a position (or supposed to be) that when the hands on the dial are indicating their relative pressures, the train line and main reservoir hands are at right angles to each other, registering 70 and 90 pounds, respectively, as shown in Fig. 1.

It may also be noticed that on the new gage the train-line hand moves as far on a 5-pound reduction as the hand on the old one moved on a 15-pound reduction, thereby telling the engineer more accurately at a glance what amount of air he is reducing, without looking at the figures. The engineer knows at once when he sees the white hand (or train-line hand) pointing to the top of the dial, that he has the proper amount of train-line pressure, or 70 pounds; and when the red hand (or main-reservoir hand) is at right angles to the white hand, the proper excess pressure is had in the main reservoir (handle in running position), and any movement of the hands from those positions shows the engineer at a glance that the air pressure is either too great or not great enough, as the case may be.

Another good feature is this: That when the train-line hand is in a horizontal line through the center of the dial, registering at 50 pounds, thus making a direct straight line with the red hand, shows at once that the full amount of braking power is had, and any fall of the white hand below this line tells at once that the engineer is wasting air. Consequently, with those very important features of the "Semaphore" gage is this: "That the engineer can give more of his attention to the track and signals, and besides permit him to handle his air in a more economical manner and make smoother and much better stops than heretofore.

Another and a very important point the writer wishes to speak of: That the gage, wherever located, be placed in a position as shown in Fig. 1, with the pipe connection pointing directly downward, and not rolled to one side to accommodate crooked pipes, etc., as shown in Fig. 2; which position, as the reader may note at a glance, is anything but correct. In fact, there is no reason why they cannot be placed in the proper position, unless it be from the lack of knowledge of this subject; as the average draftsmen and foremen employed in the locomotive works and shops, not being familiar with the advantages offered by the proper position of the new air gage and other cab fittings, nor they being instructed by their superior officers as to same, simply design and place the cab fittings in what seems to be a convenient place for all hands but the engineer, as it is he whose skill and judgment in the proper manipulation of the air brakes largely depends on such points as above stated.

On a recent visit to one of the locomotive-building establishments, the writer observed, on a large number of engines being built for a certain road, that on all these engines the air gages were of the "Semaphore" duplex type; but, as was said before, they were all placed on the brackets as shown in Fig. 2, without any apparent reason, however. It would be well to properly locate in a convenient and satisfactory place the position of the gage first, and the matter of piping may be a second consideration.

WRONG WAY

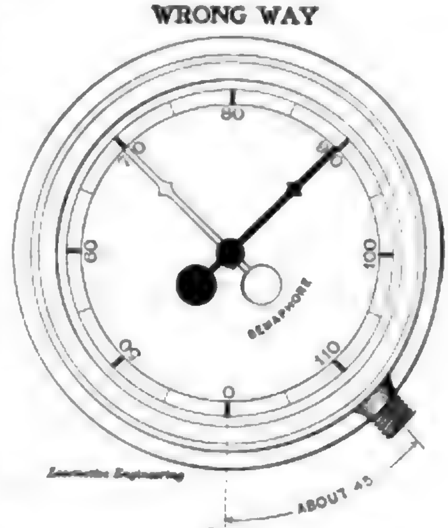


Fig.2

SETTING OF THE "SEMAPHORE" GAGE.

HARRY A. FLYNNE.

Scranton, Pa.

Piston Rod Packing for Air Pumps.

Editor:

While on a trip lately, I noticed the different kinds of packing used in air pumps and the service it gave.

Some makes of metallic packing, if properly fitted in the first place, will run from twenty to twenty-five months, if properly taken care of; and the same packing may only last a trip if put up carelessly.

There is a make of metallic packing which requires the pump to be taken apart to apply it; that is, the cylinder heads have to come off and the piston taken off the piston rod—a good two hours' job for a machinist.

Other pumps are packed with a cheap

rubber packing which will last only from six to eight weeks if the pump is in perfect condition. If its air cylinder is in bad condition it may last a week, or maybe only a trip. I have seen where pumps had to be packed three times in going over a short division. Now, where is there any saving in using a cheap rubber packing against a good metallic packing, except the first cost? And that is not all; a piston rod on a pump which is packed with rubber packing will have to be trued up when the pump is overhauled in the shop.

In figuring it up, the metallic pump packing will be found the cheapest to use, in the long run, and beside save the enginemen a good deal of work where they have to pack pumps.

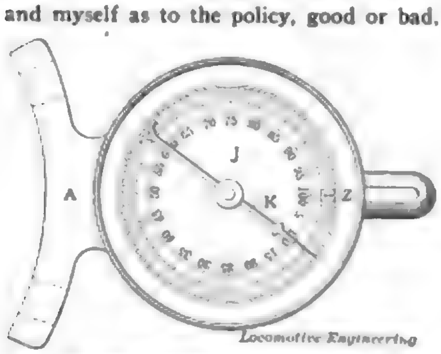
Some pumps have a good swab to keep piston rod well lubricated, while others are run without any. A good swab has a good deal to do with increasing the life of the packing, and also the rate of speed at which the pump can be run.

Sioux City, Ia. C. T. Sundberg.

"Failure of Air Brakes" Signal.

Editor:

A short time ago a discussion arose between the train-master of a road I was on and myself as to the policy, good or bad,



SYMON'S EMERGENCY RECORDER.

of blowing a special signal to the train crew to notify them that the air brake has failed, instead of whistling for brakes, as is usually done whenever the air "fails" (?).

A special signal, two short blasts of the whistle blown three times (.. .. ..) in succession is used on this road by the engineer to notify the crew that he cannot get the air to apply the brakes, and that they must stop the train at the desired mark with the hand brakes.

The advantage claimed for this signal is, that by its use the crew are notified of the condition of affairs, and would not, therefore, apply the hand brakes unnecessarily hard and stop the train short of the desired point, as they might do if a call for brakes were blown instead. Then, too, the crew would always understand that a call for brakes would mean stop as soon as possible, as in an emergency.

While a train is standing there is no doubt that much time can be saved in testing the brakes by the aid of proper signals; but when a train is in motion, and a failure of the air to apply when wanted is had, I say call for brakes—don't lose time blowing a signal that in all probability will not be understood, as a signal to indicate failure of air will be but seldom used.

Looking at the matter as I do, a signal to notify the crew that the brake has failed could be used to advantage only when the engineer had taken the precaution to try his brake a long distance from the point to be stopped at.

The instruction books tell us that whenever we are approaching a meeting point, a fixed signal or a derailing switch, we should try the brake at least one mile away; but if an engineer were to observe this rule according to the letter, and not exercise his judgment as to the proper distance in which to try his brake, he would very soon find himself a failure.

Now-a-days passenger trains are very fast; freight trains are long and heavy; and in order to make the time and get over the road in safety and on time, no opportunity must be neglected nor overlooked. To get them over the road on time the air brake does its share, and if once in a great while it should fail to respond, call for brakes—there will be little danger of stopping too soon. At least this is the way I view it. I would like to get the opinions of readers of Locomotive Engineering on this signal. J. P. Kelly.

Pittsfield, Mass.

[The provision of a signal for air-brake failure (?) is a virtual acknowledgment by a railroad of "behind-the-times" practice in air brakes. Unless criminally neglected or interfered with, the brakes will respond if allowed the opportunity to do so. We can see no logical need for such a signal. We would like readers to give their views and experiences on this point.—Ed.]

Air-Brake Practice on "Some Roads."

Editor:

In the August number of your valuable journal I notice a lengthy article by C. T. Sundberg, of Sioux Falls, S. D., criticising the maintenance of the air brake as practised by *"some roads."*

I do not know to just what railway the "some roads" refer, but would like to say that I happen to be employed as an engineer on the same road which employs Mr. Sundberg, and that the glaring evils, as set forth in your correspondent's communication, have not come under my observation during an experience of nearly ten years.

Were our brakes in the condition he says, the fast stock trains he refers to would hardly be able to make a run of 90 miles in from two hours and twenty to fifty minutes.

I think in going back over a period of six months I can recall but one case of brake sticking from local defect in trains which I have handled.

As to engineers throwing away oil in the manner he speaks of, I do not think it is done on our road for two reasons, at least. First, they are too intelligent, and second, there is too great a fear of the figures on the performance sheet at the end of the month. I am sorry to say we have brakemen who will do this, providing they can get hold of the engine-oiler when the eagle eye isn't looking.

As to roundhouse work, if our road is the "some roads" he has in mind, I think it sufficient to say that your correspondent's criticism is entirely uncalled for, and he must, therefore, mean some other road which he has visited.

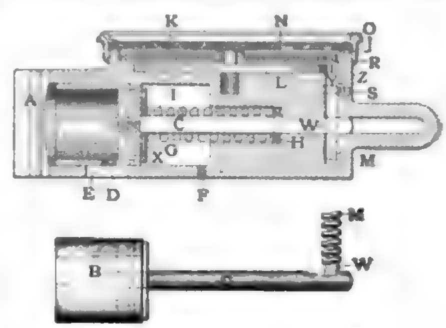
Allow me to add, in closing, that the brakemen on this division are so fat and lazy they can hardly give a signal, which would seem to indicate that the stops are made in some manner other than muscular exertion, and I think a very good quality of air has a great deal to do with it.

H. T. Carney,
Engr., C., M. & St. P. Ry.
Sioux City, Ia.

Some Air-Brake Troubles.

Editor:

The article in the May issue of Locomotive Engineering by James Bleasdale, Jr., entitled "Locating and Reporting Air



SYMON'S EMERGENCY RECORDER.

Pump Troubles," and also the article in the June issue entitled "Concerning the Instruction of Engineers," by John T. Gill, seem to me as strange, on part of second article. I would suggest heading of first article to read, "Locating and Reporting Air-Brake Troubles," for air pumps are not the only victims. While many are ever on the alert to get points concerning the troubles of air brakes, there are also many who neglect this.

The first question in the second article is, How do you start a pump? The answer in practice by many: Open full throttle and get down to oil up. Drip cocks are supposed to be automatic—close as soon as condensation has worked out. Quite a number of air cylinders are oiled at inlet of lower valve cap by filling tallow pot lid with valve oil and hold at cap until all is taken in. How many can describe the pump and trace the steam and air through it? The question, What action would a stuck valve produce, and how would you loosen it? The common prac-

tice is using a hammer; no matter what the answer to question.

The question is, Why will some men who have the knowledge not take the interest they should in locating brake troubles? The writer on one occasion had a letter come to him from an engineman, giving report of an 8-inch pump which had been on his engine but two weeks. The desire of this man was to get information and give the same to repair man. He gave the action of pump as it worked from time to time for two weeks. The pump worked well with a low steam pressure, but with a high steam pressure would stop. After releasing brakes instead of pumping up pressure it would stop until throttle was almost closed. The trouble was port *A* in upper head had scant 1-32 opening where it met reversing cylinder port, the reversing cylinder having been renewed when pump was repaired, and the taper was left as it came from the lathe, no hollow place filed around port on outside of reversing cylinder to make allowance for ports not being in line.

With low pressure of steam the small opening would allow steam to pass through and reverse pump, but with high pressure the main valve would not leave its position. This was the interested man. Along comes air pump, 8-inch, blowing all the air from upper inlet holes, gasket was leaking between centerpiece and air cylinder, back of cap nut No. 29. Engineman thinks cap is leaking; puts liner under it; result, in place of one blow making three.

Again report comes engineer's brake valve leaking main reservoir pressure into train line when valve is lapped, releasing brake on tender; on testing brake valve find it O. K., no gasket in union—between tender triple and brake cylinder the trouble. Again brake valve working badly, equalizing piston raising where valve is lapped, thereby increasing brake on train; simply air gage nut loose. The trouble, leaking away pressure in chamber *D*, allowing train-line pressure to escape at angle fitting.

Many others there are, such as when D-8 brake valve is in running position, brake goes on, main reservoir pressure is increased, must move handle to position for releasing to release brakes. When trouble is in a gummed up excess pressure valve, and a half-turn of cap nut 19 will loosen the valve from its seat and it will go to work, at end of run valve can be taken out and cleaned; many D-8 valves are ruined by allowing pump run up a high pressure while valve is on lap, making it almost impossible to move valve to release position; the high pressure on rotary causing the same and seat to cut. The brake-valve handle is often left in position for releasing too long after having accumulated a high pressure in main reservoir and the train line is charged to a higher than standard pressure, when handle is then moved to running position. The valve is lapped as the pump is shut off by governor, and main reservoir must have over and above excess carried before train line can be supplied; consequently the sneaking on of brakes, which will occur until train-line pressure has leaked below governor or standard pressure; so there is a great deal in reporting defects.

I would suggest that we give the writers of both May and June articles credit for the same, and look forward to more interest on the part of enginemen in locating air-brake troubles, to help out air-brake repairmen. F. G. Shaffer.

Chambersburg, Pa.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(63) C. M. G., Las Vegas, N. M., writes:

The engine of which I write is equipped with Westinghouse brakes. The blow-off cock is located at back end of leg of boiler. Whenever the engine is blown off, the hot water from the boiler strikes the auxiliary reservoir of the tank, and after a short time the brakes creep on, on the tank only. What is the cause of the brakes creeping on? A.—The steam and hot water striking against the auxiliary reservoir heats the air therein, which causes it to increase in pressure. Thus that pressure is made higher than that in the train pipe, and the triple moves down, setting the brake on the tender. Of course the driver brake, being supplied by a separate auxiliary whose temperature is not changed, will not set in this case.

(64) C. F., Leffert's Park, L. I., writes:

Your November issue of 1898 had the following puzzle, which I would like to have answered: "How would you keep the 9½-inch pump going safely and supply twenty cars of air at 60 pounds train-line pressure, over a mixed grade for thirty-five miles, if the discharge valve of the bottom end of the pump worked off and you lost all valve but found the cap?" A.—Mr. Kidder, of Chicago, Ill., answered the puzzle correctly in December, 1898, number. He said: "It was replaced by the lower receiving valve, and air was furnished on the up-stroke only. This change of valves could, of course, be effected in the 9½-inch pump, where all valves are of same size and lift; but could not be effected in the 8-inch pump."

(65) G. J. C., Collinwood, O., asks:

1. In a double-header, if the first engine's pump gives out, can second engine do the pumping and first engine do the braking? I claim not. A.—1. By keeping both brake valves in full release position, the second engine would pump into its main reservoir, train pipe of both engines and main reservoir of the first engine. Now, if the second engine laps its brake valve, the first engine can apply brakes all right, but may have trouble in releasing, as its main reservoir pressure is still what the train pipe pressure was before brakes were set, and will probably lack sufficient excess. 2. Why cannot second engine pump excess pressure in forward engine? A.—2. Because the second engine must pump through the train pipe into the first engine's main reservoir. Excess pressure means the greater or excess pressure in the main reservoir above the pressure in the train pipe. The second engine could pump excess in the first engine's main reservoir as well as its own if both reservoirs were connected by a pipe, as is done on some roads.

The Lunkenheimer Company's Shops.

The Lunkenheimer Company, of Cincinnati, are very busy in the manufacture of their high-grade steam specialties in the shape of safety valves, oil cups, gate valves, steam whistles, etc. About 350 men are employed, exclusive of inspectors and foremen. Considerable material of all sorts is made for use in the navy, both for the United States and foreign countries. The English Naval Board order indicator rigs, steam valves and oil cups, safety valves and all sizes of globe valves. The Russian Government comes next on the list.

Locomotive supplies are, of course, the most interesting to the readers of Locomotive Engineering. This company are now at work perfecting an injector which gives very good results. At a trial we witnessed it had a range of 50 per cent. of its full capacity when cut down to the minimum, and it could be at once opened to its full capacity and deliver twice as much water. The pressure of steam was as high as 225 pounds and as low as 25 pounds, and it could be started at any pressure. The supply pipe was heated by backing steam through it, and the injector went to work again promptly. With hot water it did good work. Only a limited number of them are as yet in service. They are trying to have them used in the hardest service that can be found to develop both their good and defective points, before putting them into the open market.

A Fellow Feeling.

Scene—Railway carriage on the Midland Railway. Enter a Colonel with gamebag and case of guns.

Colonel (to passengers, enthusiastically)—Beautiful sport; sixty birds in two hours, and only missed two shots!

A quiet gentleman sitting in the corner put down his paper, rushed across the compartment, and grasped him warmly by the hand:

"Allow me to congratulate you, sir! I am a professional myself."

"Professional sportsman?"

"No—professional liar."—*Tit-Bits.*

Aspinall's Latest Express Engine.

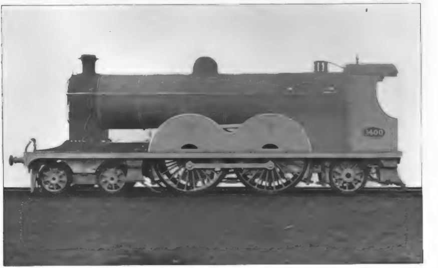
The tendency that has been very pronounced of late in nearly all countries to increase the work-performing capacity of locomotives is very well illustrated by the engine shown in the annexed engravings. The engine, as will be seen, is an English machine of the Atlantic type, and built at Horwich shops, near Manchester, after the designs of Mr. John A. F. Aspinall, locomotive superintendent of the Lancashire & Yorkshire Railway, and now advanced to the position of general manager.

The engine has a remarkably smooth appearance, a tendency followed by all British locomotive designers, and conveys to the onlooker an idea of unusual speed and power. It also represents almost the maximum specimen of speed and power for British railways, the bridges and tunnels curtailing increase of height or width.

The engine has cylinders 19 x 26 inches, driving wheels 87 inches diameter. The boiler carries 175 pounds per square inch, and the adhesive weight is 76,160 pounds. From these figures we find that the pistons transmit 108 pounds per pound of mean effective cylinder pressure, and, figured by the Railway Master Mechanics' Association rules, give 16,000 pounds tractive power and a ratio of 4.7 between adhesion and tractive power.

In some respects the engine differs considerably from current British practice. The steam ports are 17 inches long and 1⅝ inches wide. The travel of valve is 5 inches; the lap is 1 inch, and lead ⅜-inch constant, the valves being operated by Joy's motion. The driving axles are 8⅝ inches diameter at wheel seat, and 7 inches in length of seat, 7½ x 9 inches at main bearings, and the distance from center to center of bearings is 45½ inches. The crank bearings are 7½ x 4½ inches. The axles and journals of the truck wheels are of very liberal proportions. The frames, both of engine and leading truck, are made of steel plate, the former being 1 1-16 inches thick.

A notable feature in the design is the boiler, which is straight, with Belpaire firebox. At the smallest ring the boiler is 58 inches diameter, and is 15 feet long between tube plates, the total length of barrel being 17 feet 1⅜ inches. The shell is made of steel, ½ inch thick, and the throat sheet is made of ⅝-inch steel. The firebox is of copper, and is 89⅝ inches long at bottom and 42 inches wide. The depth is 83½ inches. There are 239 2-inch tubes, which provide 1,877 square feet of heating surface, and the firebox gixes 175.8—a total of 2,052.8 square feet. The grate area is 26.05 square feet. In working order the engine weighs 130,600 pounds. The distribution of that weight is remarkably good, 76,160 pounds resting upon the driving axles, 27,440 pounds on leading truck and 25,760 pounds upon the trailing wheels.



LANCASHIRE & YORKSHIRE EXPRESS.

The Sargent Company Extending.

In the course of a private letter from a member of the Sargent Company, of Chicago, the following information is given, which will interest our readers:

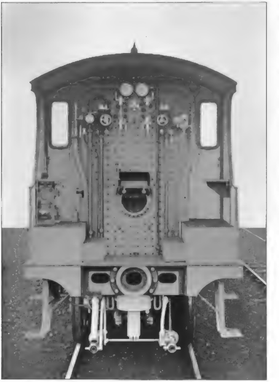
"It may interest you to know that our plant is now so crowded with business that we have been compelled to contract for a large new plant, to be located at Chicago Heights, twenty-seven miles south of the city, situated on the Michigan Central, Chicago, Joliet & Eastern, Chicago & Eastern Illinois and Chicago Terminal railways. The dimensions of the various shops will be as follows:

"The new plans, as prepared by Huehl & Schmidt, provide for a number of buildings extending over a total area of 250 x 260 feet, the cost of the buildings, exclusive of machinery and equipment, being estimated at $40,000. The buildings will be devoted to steel and iron foundries and subordinate departments. The iron foundry will cover an area of 200 x 110 feet. There will be an iron cupola room, 30 x 33; storage room, 30 x 110; core room, 35 x 110; steel foundry, 50 x 200; steel melting room, 32 x 30; workshop, 30 x 200; cleaning shop, 52 x 200. The steel foundry will be two stories high. They will be constructed of brick, stone and steel, and will be equipped with the most modern machinery, including traveling cranes of great capacity.

"We expect to have the brake-shoe department of the new works going inside of

ninety days, and the steel department by January 1st, and we shall continue to operate our present works at Fifty-ninth and Wallace streets, expecting to obtain a considerably larger output of steel in these works after the removal of the iron department.

"As you are personally familiar with the small beginnings of this company, I am sure you will be interested to know of the rapid growth of our business. When our new works are completed we shall have a foundry that, with every modern appliance, can produce three times the tonnage of brake shoes possible in our present works. Our steel department will be devoted especially to the manufacture of railway and electrical castings."



CAB OF LANCASHIRE & YORKSHIRE ENGINE.

The Allison Manufacturing Company have received an order from the Mexican Central Railway Company, Limited, for thirty caboose cars.

Machine Tool Works Combination.

The combination of several leading machine tool makers which has been talked of considerably for several months has at last been effected, and the Niles-Bement-Pond Company has been incorporated in New Jersey with a capital stock of $8,000,000. The officers of the company are: President, Robert C. McKinney; first vice-president, James K. Cullen; second vice-president, A. C. Stebbins; third vice-president, W. L. Clark; secretary, E. M. C. Davis; treasurer, Chas. L. Cornell; engineers, F. B. Miles and Geo. T. Reiss.

Directors—Alexander Gordon, president of the Niles Tool Works Company; Chas. A. Moore, of Manning, Maxwell & Moore; Clarence S. Bement and Frederick B. Miles, of Bement, Miles & Co.; Gordon Shillito, Thos. T. Gaff and Daniel H. Holmes, of Cincinnati; Frederick W. Gordon, of Philadelphia; Geo. T. Reiss and James K. Cullen, of the Niles Tool Works Company; E. C. Burke, of Cleveland, Ohio; Walter L. Clark, of the Niles Tool Works Company; A. C. Stebbins, of the Pond Machine Tool Company; W. S. McKinney, of Pittsburgh, and Robert C. McKinney, ex-officio.

The properties included in the new company are the plants of the Pond Machine Tool Company, the Philadelphia Engineering Works, Bement, Miles & Co., and a controlling interest in the Niles Tool Works Company. Of the $8,000,000 capital $3,000,000 is in 6-per-cent. cumulative preferred stock, redeemable in 1911 at 105. Of this $1,000,000 is held in the treasury for the present.

The greater part of the negotiations relating to the combination were carried on by Mr. Robt. C. McKinney.

The four companies concerned control the heavy machine trade of the country. They employ upwards of 3,000 men, and the plant of the Niles Tool Works Company alone has 15 acres under roofs. The Niles Tool Works Company and the Philadelphia Engineering Works have been under the control of Alexander Gordon, Robert C. McKinney and the Gaff estate. The Pond Machine Tool Company up to June, 1898, was controlled by J. R. Maxwell, but in that month control was purchased by Messrs. Gordon and McKinney. The firm of Bement, Miles & Co. has always been independent.

The consolidation has not been effected on the usual lines. There have been no promoters and no promoters' fees. There are no outsiders, all the stock having been privately subscribed for, though it is intended to list the stocks next winter. The management will remain practically the same as at present. Central offices will be established in New York. The registrar of the stock is the Colonial Trust Company, and the Corporation Trust Company of New Jersey is the transfer agent.

In connection with the ventilation of tunnels, engineers have found that for every pound of coal burned by the locomotive in passing through the tunnel 29 cubic feet of poisonous gas will be evolved. It has also been ascertained that if the amount of carbon dioxide can be kept so that it does not exceed 20 parts to 10,000 of air, the atmosphere of the tunnel will not be obnoxious. Fumes of sulphur and carbon monoxide form the most obnoxious gases, the latter being an active poisonous mixture.

The Safety Appliance Company, of Boston, have done us the courtesy of informing us that two enquiries about their brake equalizer have been received from abroad, one from Natal, South Africa, and one from Wellington, New Zealand; and they say: "These letters are no doubt the outgrowth of the writers having read your valuable paper."

An Improved Allen Valve.

Few American railways of importance have overlooked the Allen ported valve in the attempt to perfect steam distribution at the high speeds now in vogue, and while it has its advocates, there has also arisen a swarm of objectors, whose complaints, if rather ambiguous, are not wholly without foundation, and become more prominent as the initial pressure is increased.

As a steam admitter the Allen valve is all we can ask for, but as an exhauster it leaves much to be desired.

The larger the amount of the steam admitted to the cylinder the longer time required for it to escape through a given opening, and the maximum opening of the exhaust is not as efficient proportionately as the lesser area exposed during the first portion of the exhaust period, for the reason that when the exposed area of the port equals the area of the exhaust nozzle, it is evident that no further increase of exhaust port opening can materially assist in the liberation of the steam.

As the piston speed increases, we will find a certain velocity, after which there is no decrease of back-pressure during the return stroke of the piston, so that any increase of exhaust opening after the end of the stroke is practically valueless. It follows, therefore, that the higher the pressure at the end of the stroke, the higher the back-pressure at these speeds.

It being evident that a quicker exhaust opening was a prime desideratum, Mr. C. I. Mellen, of the Richmond Locomotive Works, designed and applied with marked success to their compound engines a type of valve which they call double-ported, in contradistinction to the Allen valve, as the port opening is doubled for a given movement of the valve at the beginning of the exhaust period, and not merely the admission period, as with the Allen.

The use of this device on their compounds has enabled them to secure high speeds and low back-pressures with a comparatively small valve.

It will be apparent from a study of the diagram that the auxiliary port acts as an exhaust port only during the earlier portion of the exhaust period, and that before the piston starts on its return stroke its function as an exhaust passage ceases, and it admits live steam to the appropriate end of the cylinder.

The engravings, Fig. 1, show in section the three positions of the valve, the direction of the steam currents being indicated by arrows, and the other cuts will show the action of the steam in the cylinders. The diagrams shown on pages 417 and 418 are taken from an engine equipped with this valve, and explain themselves.

For the purpose of illustrating the difference between the double-ported, the Allen and the plain valve, Fig. 2 has been prepared to show their respective behaviors when cutting off at half stroke. The full line No. 1 represents an indicator diagram from a double-ported valve, the dotted line No. 2 that of a plain valve, and the broken line, No. 3, that of Allen valve—all conditions being equal, with the exception of the auxiliary port.

The diagram is laid down with the assumption that the steam has the same velocity at corresponding points of the different diagrams.

The admission and expansion lines from the Allen and double-ported valves, of course, coincide, but the exhaust and back-pressure lines indicate a decided advantage in favor of the latter.

From the release point, C to E, the effect of the auxiliary port shows plainly, while the area of the exhaust nozzle is still considerably in excess of the port opening. The resulting lower final pressure effects a lower back-pressure during the return stroke.

The admission, and consequently the expansion line, of the plain valve fall below that of the other valves; the release is proportionately lower, and as the area of the exhaust opening is the same as in the Allen, the exhaust line will be beneath it all the way, while the exhaust line of the double-ported valve crosses that of the plain valve at an early portion of the exhaust period.

Another advantage of the double-ported valve is illustrated by Fig. 3, representing cards taken while drifting. The entrained air is compressed to the point A when the

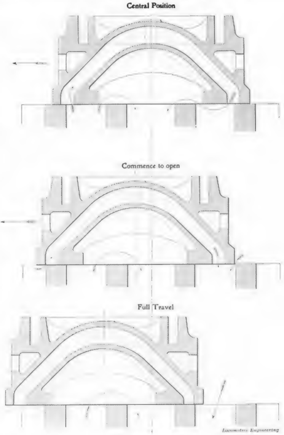


FIG. 1.

auxiliary port relieves the pressure before the piston arrives at the end of its stroke by letting the air over to the suction side of the piston, and the final compression is much lower than would be the case with the plain valve.

The following table gives the leading particulars about the indicator diagrams. The scale of indicator spring used was 100:

	Card No. 1	Card No. 8	Card No. 10	Card No. 15	Card No. 22
Revolutions per minute	52	115	147	183	231
Miles per hour	10	22	28	35	44
Boiler pressure	165	175	174	180	180
Initial pressure	165	168	171	175	163
M. E. P. H. pressure.	109.1	97.5	81.5	61.5	30.5
M. E. P. L. pressure.	38.6	32.1	28.6	21.5	17.7
Distribution of work, H. P.	53%	54.7%	53.2%	53.2%	40.7%
Distribution of work, L. P.	47%	45.3%	46.8%	46.8%	50.3%

Plain Talks to the Boys.

INSPECTION OF LOCOMOTIVES.

So you are having some trouble in regard to the inspection of locomotives at the end of a trip? You want to know how this inspection should be made, do you?

That is a matter that takes longer to tell about than to make the inspection, for the eye can look at the various parts much quicker than we can tell how and why it should be done. Do not get weary if we touch on a few facts that you know about, for it is an old subject.

In the first place, the reason for a close and careful inspection is to ascertain if any of the parts of the locomotive have been lost off, and need replacing; if any parts are worn out and should be renewed before another trip is to be made; if any bolts, nuts or joints are working loose, and need to be made secure before going any farther; or if any bearings are running warm or cutting. In this last case, the reason for its being warm or cut should be ascertained beyond a doubt, so that the proper remedy can be applied, and thus obviate the possibility of a hot box the next trip.

It is the better plan to have a regular systematic way of making this inspection, as you are then less liable to overlook any defects. By this we mean, commence at a certain place and go clear around the entire machine, first outside the rails and then if possible, under the engine.

To make a thorough and proper inspection, the engine should be over a pit just deep enough so that the engineer can pass along and examine every part, and touch every part of the motion work. Sometimes this can be done at the cinder pit, but in many cases the engine is not over a pit till long after the trip is completed, and it is hardly reasonable to require an engineer to remain with the machine till it is placed convenient for inspection. Therefore it is just as well to learn to inspect an engine when not over a pit, and find out, from actual observation, from what points of view it is possible to see portions of the machinery not otherwise visible. This is something which is different with every change in the type of engine, and can be best learned by observation.

It is not unusual for pooled and double-

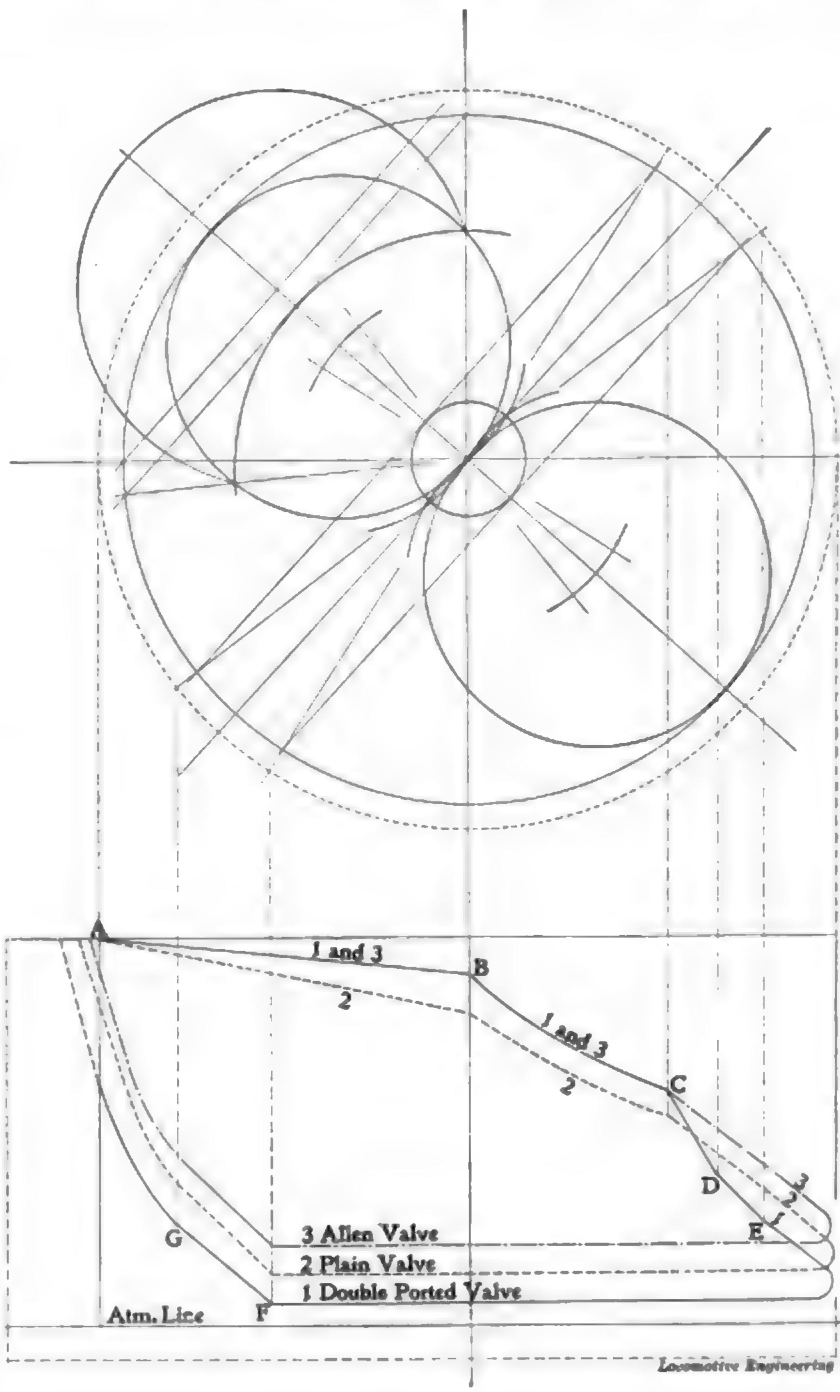


FIG. 2.

crewed engines to go right along over the next divison with their trains in case nothing is reported out of order with them. This means an inspection out on the track. With consolidation engines it is a matter of considerable difficulty; if you wish to inspect all the moving parts you should go under them.

However, we will first speak of inspection over a pit, as this is the only sure way, and then get as close to this method as possible when out in a yard.

Inspection of a locomotive to see if it is all right to go ahead on another trip is of a negative character. When we look the machine over, we do not notice the parts that are in good order, but our attention is at once called to anything in bad order or the loss of any part. We note at once the grease starting out at a joint which is working loose, and see where nuts or bolts have turned around. We see plainly the vacant spot where the head of a bolt should be. The loss of a nut is very plain, and yet if we were asked after the inspection if a certain bolt was "O. K.," very likely we would

have to examine it before being sure that it was, so soon after an inspection does our memory of the condition of the perfect parts pass from us.

Before going under an engine examine everything that is visible from the outside, feeling of all the bearings to find out if anything is running hot. The tender and all its attachments can be inspected from the outside fairly well. The flanges of all truck wheels can be inspected from the other side of the locomotive, as the part of the flange that is next the rail is then visible. Look at the tender axles right at the wheel fit, for there is where they show loose first. If the wheel shows loose at the wheel fit and cannot be moved on the axle, it is a pretty good sign that the axle is cracked inside the wheel hub. If the tender truck boxes show any unusual heat, open the cover and note the condition of the brass, the wedge and packing. If any journals on the engine are warm, examine them carefully after going under, so as to be able to report the cause of its getting warm, in order that it may receive the proper remedy. It is hardly necessary to take much time with a cold one, except to see that all the parts are still ready for service.

On the engine the binder bolts for the pedestals or jaws need the closest attention. A very little slack motion there will cause a severe pound. If the wedges are loose, you can generally see the fresh mark at the top where they have worked down on the jaw, and they will also show a mark along the side of the driving box, where the box has worked sideways. It is a good plan to take a hard hammer with you when you first start the inspection, and tap lightly on each of the bolts that are liable to work loose, and thus detect those that otherwise might not be noticed with the eye.

The valve motion is an important detail which needs careful attention, especially the eccentric cams with their keys and bolts and the straps and all bolted connections. Wipe off the lugs when possible and look for cracks in the casting; it may save you a broken strap on the road.

Cracks in the frame in some types of engines are often found just back of the cylinder saddle. It pays to look to these fastenings.

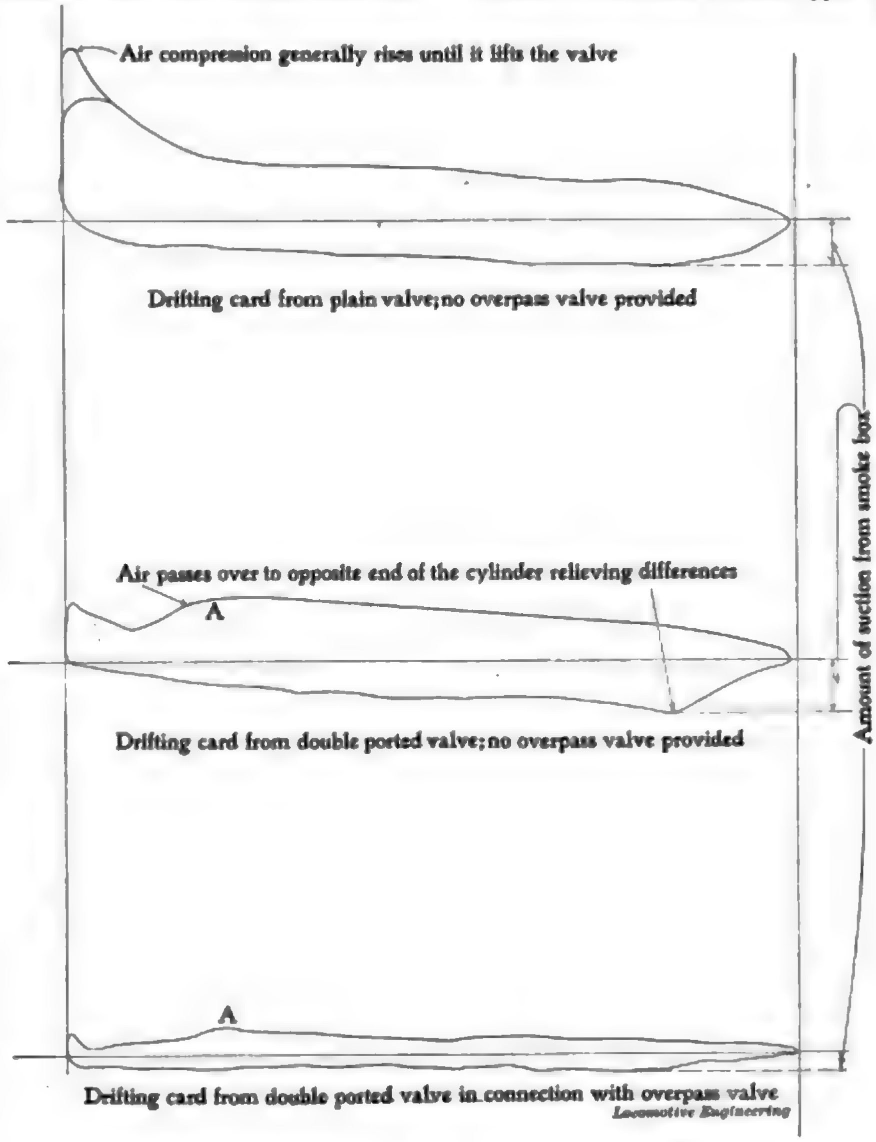
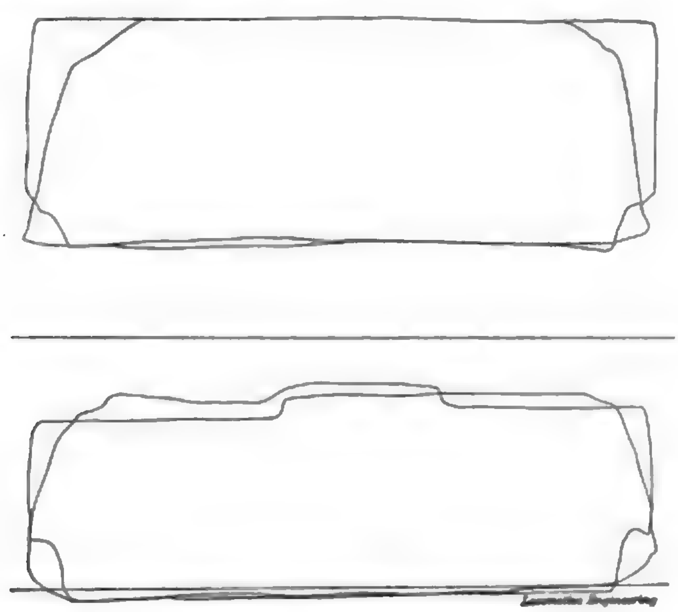


FIG. 3.



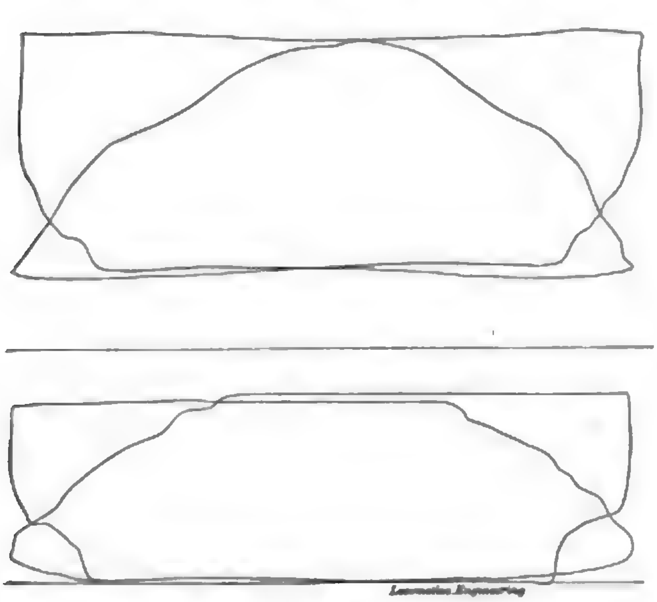
NO. 1.

Whenever possible, examine the grates from below, as one that is warped and cracked will be ready to break on short notice. This is the only way that you can see if they are all connected to the shaker, and how many cinders there are in the pan. This knowledge comes in handy if anything goes wrong soon afterward. Look at the bottom of the ash-pan for holes in it, as live coals dropping through a hole may set fires in wooden bridges that will endanger someone's life, and will surely involve the company in fire claims.

Teach the fireman to inspect the condition of flues, firebox, grates and, if one is used, the brick arch, and report to you before you separate from each other, as well as the condition and repairs, if any, needed in the firing tools. This will get

him in the way of making inspections, and when he has had experience, have him inspect the engine all over, and go with him to help him learn how to do it in a proper manner. Blows, leaks and pounds are generally located while on the road or before the final inspection at the end of the trip, so we will not touch on them now.

A loose crank pin will cause a pound



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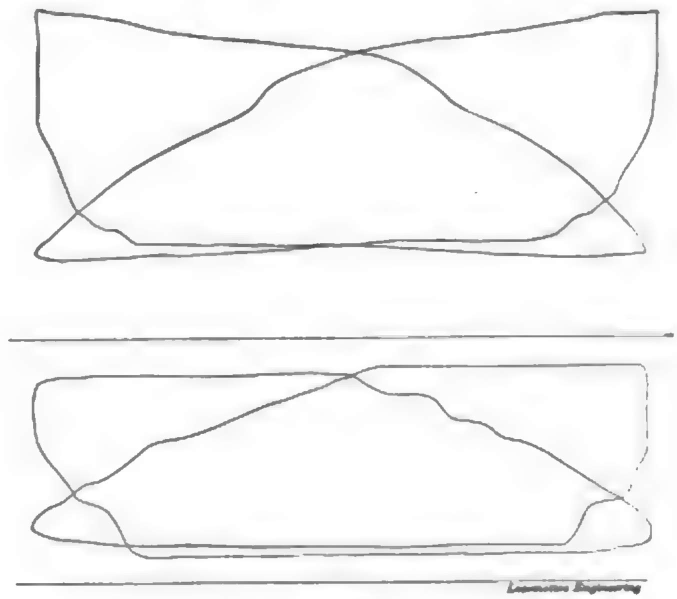

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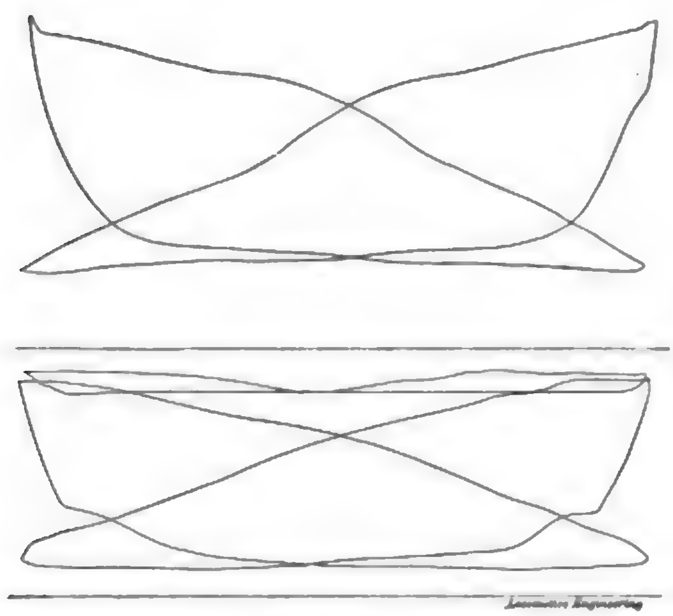

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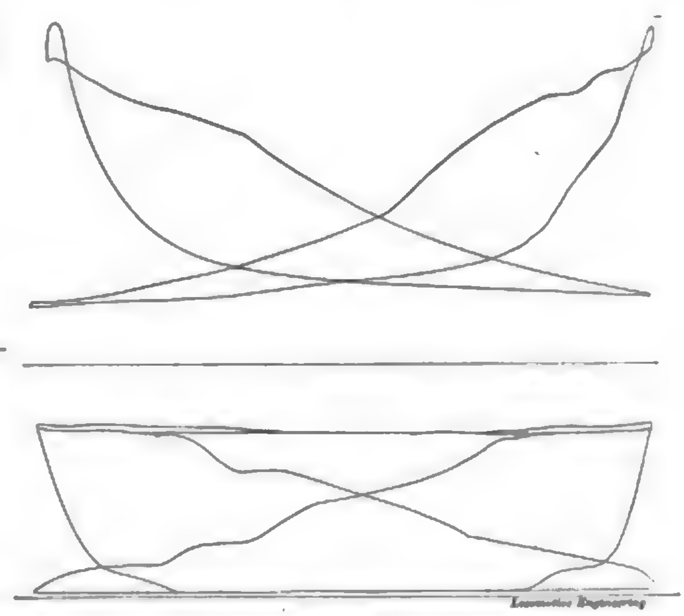


NO. 22.

that is hard to locate, but it can be located if you set the engine on the top quarter and have someone "thump her" with a little steam on.

It is a good plan to slip off the cylinder head casings once in a while, and see if all the studs are holding. Working water through the cylinders will sometimes crack off a few of them, and, the next hard pull, away goes the whole head.

When the main rod straps are down wipe them off carefully, heat them with a torch or hot iron, jar them a little with a hammer, and look for cracks in the corners. The grease will work out of the cracks pretty quick if there are any flaws starting. One important road in Buffalo tries this each time the engines are washed out, and finds about two cracked straps a month in about 100 engines. This saves a lot of breakdowns on the road. Piston rods are hard to locate cracks in while still in the crosshead, but enough are found there to pay for a close inspection by the engineer.

But a lot of inspection is of no good to anyone but the inspector, unless a correct and legible report is made on the work book. This takes less time than the inspection, but it is in a good many cases only half done.

Reports like "Packing blows," without stating what particular set is blowing; or "Trucks packed all around," when only one of them was hot and needed a new brass; or "Flues to be caulked," when it was a staybolt sizzling that needed attention, and many other reports of a like indefinite character spoil the effect of a report on the work book. In many instances needed work is not done because the repairman cannot tell from the wording of the report and an inspection of what he understands is out of order does not show anything needing repairs. If the report on the work book is plain and concise and locates the trouble so a man can go right at it whether the engine is cold or under steam, and make every move count, you will likely find that work done first and the other jobs left till some other more convenient time. Try it, boys, and see how it works. Write your report in clear, plain language; tell just where to find the trouble, and ask for no unnecessary work, just to make them

think "she is a scrap," and you will get closer attention to what you write. Telling the shop men don't go; you need to make a record of work wanted done. Put down the date, number of the engine and sign your name to it—then it goes.

Boston & Maine Improvements.

The Boston & Maine Railroad are endeavoring to be among the leaders in New England, and when their present plans are carried out they will certainly have many inducements for passenger travel.

The road-bed is being oiled to keep down the dust, the side shoveler is at work along the line, so that the appearance is being much improved, and the smoke question is also receiving attention.

They are, however, attacking it in a different way from most roads, and are to burn coke instead of bituminous coal as at present. This is to be first introduced on the switch engines, and then gradually introduced in the passenger service.

It is expected to save fire damages along the line, and as it burns more freely than even soft coal, the nozzles can be enlarged. The only change contemplated in the engines will be in the introduction of water bars in the grate. The Schenectady compounds on this road are giving satisfaction, and more are expected.

On the Chicago, Indianapolis & Louisville Railway their outside equalized brakes were at one time operated with pull-up cylinders, which gave a good deal of trouble on account of the leak usually present at the piston-rod packing. In changing them to push-out cylinders it was considerable of a problem to find room for the cylinder between the lever and the cab casting. A connection was designed by General Foreman Winkle and Air-Brake Inspector Houchin which did the work in the best possible manner. The upper end of the lever is forked so it will go each side of the cylinder-head spring case and coupled to the piston sleeve with a short curved bar or bridle.

Engine 934, belonging to the New York Central Railroad and pulling passenger trains on the Hudson River division, has made over 175,000 miles without being in the shop. The engine is run by two crews and makes 150 miles a day.

Some of the railways in Austria are experimenting with what is known as Dick's system of train lighting by electricity. Each car is provided with a battery of secondary cells capable of giving a current of 3 amperes for 8 hours. A dynamo attached to the axle is used for charging the cells or for supplying the light direct. It is said to work fairly well, especially when the cars of a train are all kept together.

PERSONAL.

Mr. J. McGie has been appointed master mechanic of the Montana Central, with office at Great Falls, Mont.

Mr. Chas. Dyer has been appointed general superintendent of the Western division, Atchison, Topeka & Santa Fé.

Mr. R. E. McCuen, general foreman, Lexington & Eastern, has been appointed master mechanic; office at Lexington, Ky.

Mr. R. R. Kimber has been appointed assistant superintendent of the Galesburg division, Chicago, Burlington & Quincy Railroad.

Mr. F. L. Richmond has been appointed superintendent and purchasing agent of the Pacific & Idaho Northern; office at Weiser, Idaho.

Mr. W. A. Dube has been appointed division superintendent of the Intercolonial Railway, with office at Levis, Que., vice Mr. A. Ouellette.

Mr. E. B. Thompson has been appointed mechanical engineer of the Chicago & Northwestern, at Chicago, Ill., vice Mr. F. M. Whyte, resigned.

Mr. Amos Turner has been appointed division master mechanic of the Lehigh Valley at South Easton, Pa., vice Mr. Phillip Wallis, resigned.

Mr. A. C. Salisbury has been appointed superintendent of the Scranton division of the Delaware, Lackawanna & Western; headquarters at Scranton, Pa.

Mr. W. L. Harrison has been appointed superintendent of the West Superior shops of the Eastern Railway of Minnesota, vice Mr. H. A. Bayfield, resigned.

Mr. George R. Rogers has been appointed general manager of the York Southern, with headquarters at York, Pa., vice Mr. S. M. Manifold, resigned.

Mr. L. B. Allen, assistant superintendent of the Fergus Falls division, Great Northern, has been appointed superintendent of the Willmar division.

Mr. F. Von Schlegell has been appointed assistant superintendent of the Fergus Falls division, Great Northern, at Melrose, Minn., vice Mr. L. B. Allen, promoted.

Mr. L. L. Smith has been appointed master mechanic of the Northwestern division of the Chicago Great Western, at St. Paul, Minn., vice D. Van Alstine, promoted.

Mr. Charles E. Ellicott has been appointed round-house foreman at Las Vegas, N. M., on the Atchison, Topeka & Santa Fe, vice Mr. George Perry, resigned.

Mr. A. C. Loucks, traveling engineer of the Missouri, Kansas & Texas, has been appointed master mechanic at Denison, Texas, in place of Mr. C. T. McElvaney, resigned.

Mr. William Chase has been transferred from lathe foreman, Logansport shops, Pittsburg, Cincinnati, Chicago & St. Louis, to Indianapolis as general foreman of machine shop.

Mr. J. E. Capps, who has been for several years foreman of car repairs of the Georgia Southern & Florida Railway at Macon, Ga., has been appointed master car builder.

Mr. F. M. Whyte, mechanical engineer of the Chicago & Northwestern, has resigned and accepted a similar position with the New York Central. Office at New York.

Mr. D. D. Bailey, trainmaster on the Atchison, Topeka & Santa Fé, has been promoted to the position of superintendent of the Panhandle division, with office at Wellington, Kan.

Mr. C. F. Gregory has been temporarily appointed master mechanic of the Chicago, St. Paul, Minneapolis & Omaha at Sioux City, Ia., succeeding Mr. J. K. Brassil, resigned.

Mr. Samuel M. Manifold, general manager of the York Southern, has resigned and accepted the position of superintendent of the Harrisburg division of the Western Maryland.

Mr. Isaac Seddon has been promoted from chief clerk in the purchasing department of the Chicago, St. Paul, Minneapolis & Omaha to purchasing agent; office, St. Paul, Minn.

Mr. J. S. May has resigned as superintendent of the Richmond division, Pennsylvania lines, to accept a similar position with the Cleveland, Akron & Columbus; headquarters at Cleveland, O.

Mr. W. G. Bayley, superintendent of the St. Louis division of the Big Four, has been transferred to the Cincinnati division, with headquarters at Springfield, O., vice Mr. Wm. Quinn, resigned.

Mr. David Van Alstine, division master mechanic of the Chicago Great Western at St. Paul, Minn., has been appointed master mechanic, succeeding Mr. Tracy Lyon; headquarters at St. Paul, Minn.

Mr. R. O. Cumback, recently appointed general foreman of the Buffalo shops of the Lehigh Valley, has resigned, to accept a position with the Central Railroad of New Jersey; headquarters at Elizabeth, N. J.

Mr. W. G. Nixon has been promoted from the position of chief clerk in the purchasing department of the Missouri Pacific to purchasing agent, with office at St. Louis, Mo., vice Abram Gould, deceased.

Mr. W. A. Garrett, superintendent of the Western division of the Wabash, with office at Moberly, Mo., has resigned to accept the position of superintendent of the Philadelphia division, Philadelphia & Reading.

Mr. Theodore Lowe, superintendent of the Durham division of the Norfolk & Western at Lynchburg, Va., has been transferred to the Shenandoah Valley and Winston-Salem divisions; headquarters at Roanoke, Va.

Mr. W. H. S. Wright, purchasing agent of the Chicago, St. Paul, Minneapolis & Omaha for the past twenty-five years, has resigned to accept the position of Western agent at St. Paul, Minn., for the Illinois Steel Company.

Mr. F. W. Williams has been appointed division master mechanic of the S. B. & N. Y. and O. & S. divisions of the Delaware, Lackawanna & Western, with headquarters at Syracuse, N. Y., vice Mr. L. Kistler, resigned.

Mr. J. H. Glover has been appointed superintendent of the Akron division of the Baltimore & Ohio, vice Mr. J. T. Johnson, with office at Akron, O. He was formerly superintendent of the Ohio and Midland divisions.

Mr. E. Graham, Jr., has been appointed division master mechanic of the Buffalo and Cayuga divisions of the Delaware, Lackawanna & Western, with headquarters at East Buffalo, N. Y., vice Mr. F. B. Griffith, resigned.

Mr. Thomas W. Demarest, who has been general foreman of the Indianapolis shop of the Pittsburgh, Cincinnati, Chicago & St. Louis Railway, has been promoted master mechanic at Logansport for the same company.

Mr. J. W. Coneys, trainmaster of the Richmond division of the Pennsylvania, has been transferred to the new Chicago Terminal division, with office at Chicago, and Mr. Edward Kearney succeeds him at Richmond, Ind.

Mr. F. M. Dean, foreman Dakota Central division, Chicago & Northwestern, at Huron, S. D., has resigned to accept a position with the Baldwin Locomotive Works. Mr. Dean is the inventor of the Dean locomotive track sander.

Mr. C. B. Rhodes has been promoted from foreman of locomotive repairs to be master mechanic of the Georgia Southern & Florida Railway, with headquarters at Macon, Ga. He has proved himself a very efficient and popular official.

Mr. Robert O'Brien has been appointed master mechanic of the Richmond & Petersburg division of the Atlantic Coast Line, at Richmond, Va., succeeding his father, Mr. John O'Brien, recently appointed general fuel clerk at Manchester, Va.

Mr. R. D. Fowler, division superintendent of the Chicago & Eastern Illinois, at Danville, Ill., has been appointed superintendent of the St. Louis & St. Elmo division, with office at Marion, Ill., and is succeeded by Mr. John C. Muir at Danville.

Mr. Ed. Scallen, general foreman of locomotive repairs of the Vicksburg, Shreveport & Pacific, at Monroe, La., resigned that position recently on account of malarial trouble. His present address is 2606 Seventeenth avenue, South, Minneapolis, Minn., and he is looking for a similar position.

Mr. J. K. Brassil, employed for the past twenty-two years by the Chicago, St. Paul, Minneapolis & Omaha, has resigned to accept the position of master mechanic of the California Northwestern, with headquarters at San Francisco, Cal. Mr. Brassil was tendered a reception by the engineers and firemen of his division, and presented with a handsome diamond ring. They also showed their high esteem for Mrs. Brassil by presenting her with a diamond pin.

The headquarters of Mr. J. H. Goodyear, assistant general superintendent of the Buffalo & Susquehanna, has been transferred from Galeton to Austin, Pa. In addition to his other duties, he will have charge of all train and engine men working between Keating Summit and Galeton. Mr. Goodyear was with the Chicago Great Western until a short time ago. His name is well known to our readers as a contributor to the columns of LOCOMOTIVE ENGINEERING.

Mr. W. C. Pennock, master mechanic of the Pittsburgh, Cincinnati, Chicago & St. Louis Railway at Logansport, Ind., was drowned in Hudson Lake, near Laporte, Ind., on July 17th, while trying to save the life of a companion who was in the water. Mr. Pennock began railroading as a fireman in 1880. He was road foreman of engines for a number of years on different divisions, till September, 1893, when he was promoted master mechanic. He was educated at Gambier College and at the Stevens Institute. At the time of his death he was thirty-seven years old.

Mr. P. J. Hickey, who has been an engineer on the Chicago division of the Cleveland, Cincinnati, Chicago & St. Louis Railway for the past seventeen years, was appointed road foreman of engines on August 1st, with jurisdiction over the Cleveland-Indianapolis, Cincinnati-Sandusky and Michigan divisions; headquarters at Indianapolis. When the Westinghouse instruction car was on the Big Four route in 1892, he was with the car about six months. He is an active member of the Air Brake Men's Association. Mr. J. T. Malone, road foreman of engines, will have jurisdiction over Chicago, St. Louis and Cairo divisions.

Mr. Phillip Wallis, master mechanic of the Lehigh Valley at Easton, Pa., has been appointed superintendent of motive power and equipment on the Long Island; headquarters Richmond Hill, N. Y., in place of Mr. S. F. Prince, Jr., resigned. Mr. Wallis is a graduate of Stevens Institute, and has had the kind of experience that makes college graduates the best kind of mechanical superintendents. After leaving school he went to the Chicago, Burlington & Quincy shops at Aurora, Ill., and worked for some time as an improving machinist. From there he went into the test department, and rose to be chief engineer of tests. Then he was appointed general foreman of the shops, and from there was advanced to be master mechanic of one of the leading division shops of the road. From there he went to be assistant superintendent of motive power of the Norfolk & Western, and from that went to be master mechanic on the Lehigh Valley. He is an excellent executive officer, and has always been very popular with the men under his charge.

An Incident of Travel.

Mr. W. F. Dixon, general manager of the Sormovo Locomotive Works at Nijni-Novgorod, Russia, has been on a brief visit to this country, in company with his wife. Mr. Dixon was here partly on business, as he was authorized to purchase a variety of tools to be employed in extending the capacity of the works. The directors of the company were exceedingly liberal with their general manager in connection with his holiday. Mr. Dixon tells of an amusing "incident of travel" in connection with a journey by rail. Mrs. Dixon has an American traveler's trunk, which is not the common receptacle for baggage used in Russia and excited more or less attention. Shortly after the train left St. Petersburg Mr. and Mrs. Dixon went into the dining car and sat down at a four-seat table. Shortly afterwards two Englishmen came in and took the other two seats. "Did you see that Yankee trunk on the platform?" demanded one of the other, and then he began a tirade of virulent abuse of Americans as none but an insular, ignorant Englishman knows how to express. He said that he would not ride in the same car with an American. They were all loud-mouthed, ignorant and of uncleanly habits, and he practiced keeping as far away from them as possible. Mr. and Mrs. Dixon were talking in Russian together, so that the Englishmen were not likely to suppose one of them was an "ignorant Yankee." When the Englishmen had tired of abusing Americans he asked a question of Mr. Dixon in particularly fragmentary French. Mr. Dixon answered in the same language; but the fellow floundered so hopelessly in trying to begin a conversation, that Mr. Dixon remarked, "You had better talk in English. I am an American, but I think that I can talk English in a way that you will understand it." The Englishman suddenly thought he had forgotten something, and went to look for it. Perhaps his dinner did not agree with him, for he did not return to the dining car.

Pilsbury's Smoke Preventing Firebox.

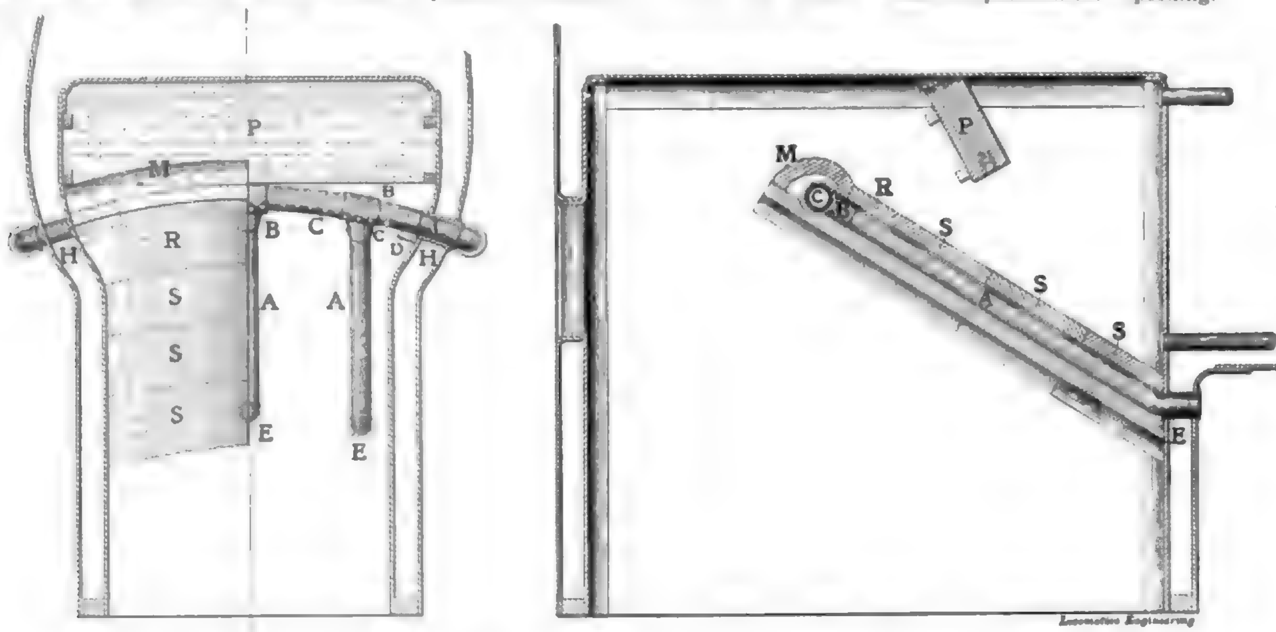
The smoke-preventing brick arch of the Queen & Crescent, illustrated on page 366 of our August number, has brought to our notice a similar device used years ago.

In 1884, while master mechanic of the Eastern Railroad, Mr. A. Pilsbury, now superintendent of motive power of the Maine Central, got out a form of brick arch providing for air admission through the arch, coming out at the top. He took out a caveat for the invention, but never had it patented. The invention was applied to an engine on the Eastern Railroad and gave excellent results, having been in service over a year. The matter was not carried further because Mr. Pilsbury left the road, and several official changes subsequently took place on the Eastern Railroad, and among them the device was neglected and afterwards forgotten, but its usefulness and utility were substantially established.

We have received from Mr. Pilsbury a blueprint of the device, from which the annexed engravings were taken. It will interest some of our readers to know that Mr. A. M. Waitt, now superintendent of motive power of the New York Central Railroad, was chief draftsman for Mr. Pilsbury when this form of arch was designed, and he made the drawing from which the blueprint referred to was taken.

The brick arch is supported on lugs *D*. There are three air tubes, *A*, fitted into thimbles at the front end of the firebox at *E*, and terminating at the upper ends of the tubes in T fittings at *B*. The T's *B* and thimble *E* form slip joints, which admit of and provide for all the movement necessary and required by expansion.

It will be noticed that the cross pipes connecting the upper ends of the T's are perforated, and in turn covered by perforated curved fire brick, so that the air is delivered at the point and manner most suitable for aiding in consuming the gases. The deflecting arch *P* is not an essential part of the arrangement, and was not used in engine fitted with the device.



Cross Section — Longitudinal Section

PILSBURY'S SMOKE-PREVENTING FIREBOX.

Moving Platforms Again.

People who visited the Columbian Exposition got fairly familiar with the moving platform which was designed to enable passengers to step upon a moving train without requiring the latter to stop. The Chicago experiment was not productive of the practical results expected; but the friends of the system have not abandoned their scheme, for it is going to be a conspicuous feature of the transportation facilities of the Paris Exhibition next year. As an aid in developing the system an experimental section has been erected at Saint-Owen, a station in the neighborhood of Paris. There are three platforms, one being stationary, the next one moving at a speed of 2½ miles an hour, the next one double that speed. It is expected that passengers will be able to step from the top movable platform to the steps of railway cars without difficulty or danger

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In the Rakaia railway smash, says a New Zealand paper, drink was the direct means of saving the lives of about sixty excursionists who, as the night was cold and wet and the train was waiting, left the rear carriages and trooped into the railway hotel a few yards off. While they were drinking the smash took place. The carriages which sixty of the beer-thirsty crowd had quitted were reduced to matchwood.

A Locomotive Race.

BY F. M. NELLIS.

The "185" stood nearly completed in the erecting shop of the Pittsburgh Locomotive Works. She measured 15 feet from the rail to the top of her Russia iron-jacketed stack, and, tall and gaunt-looking, seemed to know and feel the purpose for which she was being specially built. The large boiler, high driving wheels and 200 pounds' steam pressure seemed to have held consultation and sworn to wrest from the enemy the old-time honor of the parent shop. In fact the "185" was being specially built to outspeed a rival which had recently defeated her sister locomotives. She was to lift the stigma of defeat and bring back to her parent shop the long-established and well-known reputation for "speeding."

Piece by piece she was carefully fitted together. The painter followed the mechanic closely, until, finally, the "185" steamed down through the yard under the control of Charley Wolf, the young engineer who was to drive her to victory. Then she was disconnected and packed to run on her own wheels to her destination.

"Wolf," said the superintendent to the young man, who had been summoned to the office, "you are just the age to be reckless and not know what fear is. On this trip I want you to combine the recklessness of a boy with the skill and coolness of a veteran engineer. You will learn the details when you arrive there, and will probably have a race the first trip out of St. Louis. I want you to win that race. Tear the wheels from under this engine rather than have the Vandalia's competing line beat her." With these instructions Wolf left the office.

A few hours later Wolf was on his way to Terre Haute with the finest specimen

of a fast passenger engine he had ever seen. During the two weeks he spent with her pulling freight between Terre Haute and East St. Louis (a sort of preliminary course of training preparatory to making the trial fast run), Wolf learned that Ohio & Mississippi engine No. 69, engineer Kelly, had repeatedly beaten the Vandalia engines, and was acknowledged to be the fastest passenger engine running out of East St. Louis. A trophy, a chamois skin with a Mercury foot worked upon it, had been presented by the commercial traveling men of St. Louis to the engine proving herself the swiftest on these two competing lines. The commercial men were pledged to travel on the galded. The netting in the smokebox was too fine for the Illinois coal used on the Vandalia. These faults, however, were carefully corrected, and the day for the trial fast run arrived.

About 9 o'clock in the evening the "69" and "185" were backed into the relay station at East St. Louis to wait for their trains from over the river. Kelly, seeing the "185" for the first time, climbed down from the "69" and came over to where Tom Manafee, the engineer who had been assigned to pilot Wolf on the trial fast run, was oiling around, preparing for the race; for they knew there would be a race, and a hot one, too.

"Hello!" shouted Kelly, as he gazed at caught up. Then they were to try each other's mettle. The racing ground was an ideal one. For thirteen miles the two tracks were level and parallel, perfectly straight, and less than 100 feet apart. Then they diverged.

Both trains came off the Eads bridge into the relay station twenty minutes late, which gave the two engines a splendid opportunity to race. How high and defiant the "185" looked as she stood there under the electric lights, being coupled on to her train! her paintwork, of black and gold, clean and shining; her Russia iron jacket and bright iron parts gleaming like polished silver, and her brass trimmings and copper pipes glistening like

"How high and defiant she looked as she stood there under the electric lights! her Russia-iron jacket and bright iron parts gleaming like polished silver, and her brass trimmings and copper pipes glistening like burnished gold. Her huge driving wheels betrayed the terrific speed lurking there."

line whose engine held the trophy. Many an exciting brush there had been for the possession of the trophy, and many times had it changed hands. This "sheepskin," as the trophy was called by the railroad men, floated from the headlight hand-rail of the winning engine, and did more to influence travel than the advertising of the enterprising passenger agents. The "sheepskin" passed backwards and forwards, first to one engine, then to another, until the Ohio & Mississippi engine 69 was built at the company's shops at Vincennes, Ind. She was very speedy, had won the "sheepskin" on her first trip, and had held it ever since. This was the engine the "185" was to defeat.

Several little delays were experienced in getting the "185" into shape for doing high-speed work. The side rod brasses ran hot. The right cross-head cut the guides. The left back eccentric strap the extraordinarily large driving wheels under the "185." "What does that long-legged thing expect to do?"

"Beat the '69' and win back the 'sheepskin' to the Vandalia," growled Manafee, pulling up the wick in his torch.

"I guess not," rejoined Kelly. "Why, the whole blamed pile of scrap iron isn't worth one of the '69's' driving wheels. She wont get near enough to smell the '69's' smoke."

"Wont, hey! That's all right, Kelly," said Manafee, "we'll talk more about that to-morrow." They stopped their chaffing and proceeded to arrange the details of the race. Both trains would leave from opposite sides of the station at the same time. Both would have to come to a full stop at the intersection of the tracks, about a half mile from the station. Whichever train got the intersection signal first was to proceed slowly until the other train burnished gold. Her huge driving wheels betrayed the terrific speed lurking there. The clouds of black smoke exhaled from her stack at each throb of the air pump seemed to give breathing life and impatience to the magnificent machine. Across the platform, on the opposite side of the station, stood the formidable "69," the champion of champions, with the "sheepskin" hanging limp from the headlight hand-rail. The "69" suggested the sturdy Western broncho, while the "185" more nearly approached the long, sleek, slender-limbed race horse.

Both crews were at their stations, awaiting the starting signal. It came to both simultaneously. Both engines started their heavy trains with difficulty, and proceeded abreast to the intersection. Both engines called for the signal simultaneously. Kelly got it first, however, and proceeded. Instead of waiting for the Vandalia train

as he promised, Kelly shot away as fast as the "69" could carry him. At this treachery Manafee muttered an oath and pulled the throttle of the "185" wide open. She quivered and trembled like a nervous race-horse under restraint, and then moved off slowly with the heavy train. "Here, Wolf," said Manafee, "take her. She's yours yet until after this run."

Wolf climbed upon the box and took the throttle. He seemed to know the "185" better than ever before, and believed she knew and recognized him. She was working hard getting the train under way. The high-pressure steam lifted the fire off the grates at each exhaust, and produced a sound in the firebox like many fourth brought him nearer. When the fifth was passed he could distinguish the glass in the rear door of the last sleeper on Kelly's train. The sixth, seventh, eighth and ninth miles were covered in, respectively, 57, 52, 50 and 49 seconds by Manafee's watch. This brought the "185" abreast of Kelly's second sleeper. She was gaining steadily. None of the men in the "185's" cab spoke or made any demonstration. Each watched his individual part with nerves strained to the highest possible tension. Wolf could feel the sympathetic current flowing between this noble machine and himself as he sat with his hand on the throttle. No jockey and horse ever understood each other better than did the "185" and Wolf that night.

It was a grand sight to behold—those two powerful machines boring swiftly through the night; the smokestacks pouring forth streams of fire, which rose high in columns and then curved gracefully back over the train, where they fell in pyrotechnic showers. Excited passengers, waving handkerchiefs, were at every window. Baggage agents, mail clerks and Pullman porters were gesticulating wildly and shouting at the tops of their voices, in vain efforts to be heard above the din of the fast-flying trains. A pretty sight it was to see the fireman, skillfully poised in the rocking gangway placing with exactness the shovelful of coal to some remote and difficult spot in the firebox of the careening engine. The deep lines in his face showed his intense anxiety, and also his appreciation of the fact that an accidental or carelessly placed shovelful of coal might mean a sacrifice of several pounds of steam, and consequent loss of the race. Manafee sat crouched and leaning forward on the fireman's box, as though trying to push.

A belated hunter, with hounds tugging at their chains, crouches by the roadside, and gazes awestricken at the plunging trains. There is a glint of steel and gold as the "185" passes, followed by the crashing and grinding of the train wheels.

"Out of the deep darkness plunge the steeds of steel, surging and swaying. Columns of fire belching from the smoke-stacks shed a soft, diffused glow on the picture as the trains come tearing on. Bright coals dropping through the grates into the ash-pans light up the under side of the engines, and show the marvelously rapid movements of the machinery."

men with heavy hammers pounding on the sheets. Faster and faster she went. The red tail lights on Kelly's train were scarcely visible through the darkness. There was no moon. The night was close and muggy—just such a night that engines do their best work. The large drivers were now revolving so rapidly that the connecting rods could scarcely be seen even when the furnace door was opened. The hammering in the firebox had ceased, giving way to a roar like a strong wind. The fireman watched the steam gage with the sharp gaze of a hawk. Manafee sat on the fireman's side, grim and watchful. The third mile-post had been passed, and Wolf had gained but little on Kelly. The

A whirling cloud of dust and smoke, filling in the vacuum at the rear of the train, momentarily hinders the vision of the watchers gazing after the rapidly contracting red tail lights.

The engine whistles shriek out defiantly the road-crossing signal at intervals. The farmer up the track hears and knows the signals, and he knows also that a race is on. He has seen the handsome, clean-cut stranger passing his door in menial service many times during the past two weeks, and his sympathy is with her in this race. He lays aside the harness he is mending, goes to the door and looks out into the darkness. Far down the track he sees the headlights of the two engines

twinkling like twin stars. Gradually the lights grow larger and more brilliant. He can now see the streams of fire pouring from the smokestacks, and he hears the low, distant thunder-like rumble of the rapidly-approaching trains. Each time the firemen add fresh fuel to the furnaces the diverging fan of light from the incandescent mass in the firebox pierces far up into the dense black sky. The headlights grow larger and brighter. The streams of fire shoot higher. The shrieks of the engine whistles seem more defiant now. The sound carries through the still night air and reverberates through the sycamores and cotton-woods fringing the banks of the sluggish stream at the foot of the bluffs far across the prairies to the right. How swiftly the trains approach! How close they are together! The farmer has seen many races over this course, but none so close and swift as this one. He hastily calls his wife, and together they stand framed in the doorway of the lighted room, gazing out into the night, entranced by the splendor of the spectacle. Out of the deep darkness plunge the steeds of steel, surging and swaying. The columns of fire belching from the smokestacks now shed a soft, diffused glow on the picture as the trains come tearing on. The bright coals dropping through the grates into the ash-pans light up the under side of the engines, and show the marvelously rapid movements of the whirling, curving, plunging machinery. With a roar like a tornado the racing machines with their trains tear by. There is a flash of silver-polished steel and burnished gold as the "185" passes through the broad ray of light from the farmhouse door. Clouds of dust and smoke roll in through the doorway, and sparks, some alive, some dead, fall in hail-like showers in the prairie grass around the farmhouse.

When lacking but four car lengths to lead, the "185" suddenly ceases to gain, and both trains, neither having the advantage, fly along side by side. Now the "69" actually begins to draw away. The "185" is falling behind! Can it be that after such a magnificent achievement she has done her best and is "dying?" No! It cannot be! It shall not be! On! noble steed of iron and steel, on! The deathly-pale young man with a veteran's skill is at the throttle and urges you on faster! On, then, faster! Faster! Seventy miles an hour is fast, but go faster, faster still! In his Pittsburgh home sits a stern old man, anxiously awaiting a message telling of your victory. Every telegraph operator, every train crew on the road tonight knows that the race is on, and hopes to greet you as the winner. In their fancy they see you tearing through the night, leaving behind you the electrically lighted city, and fighting doggedly every inch of the way over the Illinois prairie with your redoubtable rival. On, then! Faster! Faster! Fly!!

"Forty-eight seconds," calls Manafee, watch in hand, as the eleventh mile-post is passed. The right injector is eased off until the steam gage registers 195 pounds, then the throttle is widened. The effect is marvelous. The sensitive machine responds as quickly as a horse under the lash. She is gaining now, and is gaining even more rapidly than before. What is the trouble with the "69"?

The engines are abreast now, and Wolf can see across the broad ditch into the "69's" cab. Kelly is plainly in distress; for by the dim cab-light Wolf can see him bending over the boiler-head, and each time a pale-blue vapor rises. The race is practically over! The tell-tale blue vapor indicates that the water is low in the "69's" boiler. She is "dying!" This information Wolf yells to Manafee, who, in his joy, flings his cap in the air and loses it out of the window.

On the siding, just ahead, stands a plebeian freight with locomotive headlight hood closely drawn, indicating that the main track is clear. The crew stand with torches and lanterns near the side, and seek to encourage the "185" on by giving extravagant "Clear track," "Go ahead" signals. Their lusty, concentrated cheer, as the "185" rushes by, a full train length in the lead, is stimulating to the pale-faced Wolf, leading the aristocratic machine to victory. As the divergence at the end of the course is approached, he looks back for Kelly, who is now far in the rear, badly beaten. No Derby winner, under whip and spur, ever passed under the wire a more glorious victor than the "185," as, shrieking and snorting, she fairly flies from the prairie off among the foot-hills at the end of the course. No jockey ever sat in the floral chair more proudly than sits Wolf on the box of the "185," weak and exhausted, welcoming the refreshing night air as it comes rushing in with the force of a hurricane through the open front window. How happy he totters down through the high gangway to the ground when the first stop in fifty-one miles is made at Greenville to take water. How affectionately he pats the sides of the heavy, throbbing machine as he passes to the telegraph office to wire a brief message of victory to the Pittsburgh superintendent.

"Who won?" excitedly calls the operator.

"The '185,'" replies the bare-headed, bronzed Manafee, who proceeds to tell of Kelly's treachery, the last dying spurt of the "69" and the splendid performance of the "Pittsburgh speeder," which towered proudly above the admiring throng of night-train visitors, her haughty and dignified pose suggesting a consciousness of her wonderful achievement.

The news of the victory is telegraphed ahead. Side-tracked crews greet with whistle-shriek and lantern movement the bird-like passage of the winner, and tele-

graph operators dip their semaphores in her honor as she approaches. About midnight she glides into the station at Terre Haute, having made the run of 168 miles in less time than that made by any previous engine. She is welcomed by a motley group of railroaders, from the superintendent of motive power down through the ranks to the humble wheel-tapper and engine-wiper. He is besieged on all sides for detailed news of the race, and Manafee tells the story over and over again.

The next day a bulky letter from Vincennes arrived for Manafee. It read as follows:

"THOS. MANAFEE, Esq., Terre Haute Ind.
"Dear Sir—Enclosed find sheepskin.
"(Signed) KELLY."

About noon next day a telegram was handed to Wolf. Tearing it open, he read the following:

"C. M. WOLF, care W. H. Prescott, Supt. M. P., Vandalia Line, Terre Haute, Ind.

"Return to Pittsburgh and arrange for six weeks' vacation at full pay.
"(Signed)
"PITTSBURGH LOCOMOTIVE WORKS."

Rarest Wood in the World.

The very rarest wood is the calamander tree, of which there are known to be only ninety specimens in the world. They are on the island of Ceylon, where each tree, numbered, is under protection of the Governor. These trees, the last of their kind on earth, are held almost in religious reverence by the natives, who guard them as among their most sacred treasures. At the Columbian Exposition there were five pieces of furniture of these excessively rare trees. The exhibit was insured for $250,000. Not even the kings of the earth dare cut down any of the ninety calamanders, whose pricelessness is far above that of a ruby mine. Allied to the ebony family, calamander wood is of a dark chocolate color or exceeding richness and brilliancy, mottled in a way almost indescribable.

One of the most profitable woods is sandal wood. The East Indian Government has had a monopoly on the sandal wood trade, to the enormous profit of the stockholders, for several hundred years past. The method of preparing the wood tree for market is interesting. After the tree has been felled it is allowed to lie for a few weeks, during which time, on account of its pungent odors, it is assailed as a delicious morsel by myriads of the voracious white ants of India, and these greedy colonies soon leave nothing but the heart, which is the sandal wood of trade. Sandal wood cuts beautifully under the chisel, and specimens bearing 75,000 impressions to the square inch have come from the engraver's tool.

The toughest and most lasting wood is lignum vitæ. It is tougher than steel, and will outlast brass. It is used now on our great warships for bearings, in which to run the shafts of the immense machinery; and the shafts usually wear out long before the lignum vitæ shows any appreciable signs of change. The wood is a dark gray, with a thin, smooth bark, and a stick of it vies with a stick of lead in weight.

Sometimes timber has been known to last 1,000 years. The roof of Westminster Hall is over 450 years old. In Sterling Castle are carvings of oak well preserved, after 300 years. The trusses of the roof of the basillica of St. Paul, Rome, were sound and good after 1,000 years of service. Piles in a perfectly sound state were dug from the foundation of the old Savory castle, after having been down for 650 years. Timbers of tamarick wood in a perfect state of preservation have been found in the ancient temples of Egypt, in connection with stone work known to be at least 4,000 years old.

Big Order From Berlin.

An unusually large cablegram order has just been received by the Buffalo Forge Company from the Deutsche Niles Werkzeugmaschinenfabrik, Berlin, Germany. It is for the heating and ventilation of the new works of the Berlin company, and is the most extensive foreign contract of this character placed the present season.

The heating and ventilation of the Deutsche Niles Works are worthy of special note, and some idea of the size of the machinery, together with the extent of the buildings, may be derived from the following data:

The apparatus for the machine shop consists of two full housing duplex fans, each standing 180 inches tall. With these fans will be used 23,000 feet of Buffalo fan system heating surface. The foundry heating and ventilating outfit consists of two full housing fans, each standing 140 inches tall. With these fans are used 10,000 feet of heater. If the pipe of the above two heaters were laid in single continuous lengths the distance covered would be very nearly six miles of 1-inch pipe.

The Buffalo Forge Company have also received a cablegram from the Berlin company for a complete equipment of machinery for their forge shop.

A radical change is being made in the appearance of the baggage, mail and express cars on the Baltimore & Ohio Railroad. The platform and hoods are being removed to increase the element of safety and save weight. The favorite riding place of tramps is also eliminated when the platforms are removed. General Manager Underwood has also issued an order to remove the numbers from locomotive tenders, so that, in cases of emergency, those of the same style will be interchangeable.

The Pool System.

In your March number I made a few remarks on the pool system as I saw it, and gave some figures as to extra cost, which may be verified and considerably increased, and confidently expected to have a more plausible argument produced and some facts and figures given in rebuttal by the advocates of the pool system. But up to date, after reading the articles in your June and July numbers by Messrs. Whelan and Leach, I must confess that I feel like a man might who had gone hunting where there was no game, or had gone fishing with a net with too large a mesh, and the fish all slipped through. Mr. Whelan starts out by saying, "The advantages of pooling are that traffic may be handled with a lesser number of engines." If he had extended the sentence and made it read, a lesser number of engines at one time, he would have been nearer right. To illustrate this more clearly, let us suppose that a man needs two pairs of pants per year. And if he bought one pair on January 1st and wore them continually until July 1st, and the next pair from July 1st to January 1st, or if he bought both pair January 1st and wore them on alternate days he would in the first system save the interest on the price of one pair of pants for six months, would he be called extravagant if he adopted the second system? And the chances are that he would save money, and the pants would last longer, because he could then leave one pair at home for a much-needed half-soleing.

Mr. Whelan makes another statement, and says, "It is a common thing for engineers to work seventy-two hours under the old system, which was bad practice; they were not safe, etc." Now, I heard an argument produced—a sort of a consolation prize or a pacifier for engineers, telling them that they could make more time under the pool system, as they didn't have to wait for repairs to be made, but could take another engine and go. However, I have known of 100 crews in the past sixty days asking for rest under the pool system, which shows this charge can't be laid at the door of the system. The fact of the matter is that spurts of business cause men to work longer than they would or than they should if it were not for the force of circumstances which cannot be overcome except by having a large extra list, which is a source of aggravation when business begins to fall off and resumes normal conditions. Mr. Whelan takes me to task for saying all engines of a size and build are not alike, and thinks an engineer should be able to run one engine as well as another. But I shall stick to my first assertion, that there is more or less difference in all engines, largely due to the coring and shrinkage of the cylinder castings, and the small difference in make-up and arrangement due to the fallibility of man. And 90 per cent. of the American engineers will bear me out in this statement; and if we were to admit that there was no practical difference in a lot of engines when built, it would be but a short time when there would be an apparent difference, and the regular engineer is able to take advantage of the strong points, and largely overcome the weak ones; whereas the engineer who runs twenty engines never will. The regular engineer knows the liability of a certain pin or bearing to run warm, or a nut to come loose, etc.

Mr. Leach, in the July number, starts out by saying "sentiment is against pooling." It seems to me he used a rather poor argument, for sentiment usually follows right. It was sentiment that prompted me to write an article on the pool system. It was sentiment that abolished slavery; it was sentiment that caused the pilgrim fathers to hunt a new home; and we make the prediction that sentiment will cause an investigation that will do away with the pool system.

Mr. Leach says inspectors are needed under either system. I would again differ with him, and I believe an intelligent engineer who starts to inspect his engine as he oils around and continues throughout the trip, is able to tell more about the condition of his engine in five minutes than the ordinary inspector can in an hour. My experience with inspectors has been that they are not what they should be, but are too often men of small calibre, men who have been pulled off an engine for incompetency, lack of sobriety or a physical disability, or have secured the position through charity; and one might suppose that they had been placed there by a course of reasoning like that of the coon dog. They were good for nothing in any other capacity, and by the eternal fitness of things, in consequence, must be good inspectors. And it usually follows that the outgoing engineer finds more work to be done while oiling around than did the inspector. Mr. Leach makes a good point, when he says under the old system we often find a big train and a small engine first out or *vice versa*. But to offset this argument, under the pool system we too often have a large train first out and a large engine last in, or just coming in when the train dispatcher orders her out, and she is coaled, fire partially cleaned and turned around, and starts on the return trip with a warm pin or journal, a dirty boiler, flues leaking and unsuspected, carrying with her all the possibilities of delay or failure, not in condition to pull either a heavy or a fast train. The train dispatcher congratulates himself on the workings of the pool system; the engineer curses, and the conductor reports an engine failure, and the officers of the mechanical department stand with bowed heads to accept the inevitable censure for engine failure.

To avoid the above conditions under

either system, engines should be divisioned by sizes as much as possible, or different classes put on branches and the main-line business handled with one class of engines as far as practicable.

In regard to getting over the road or pulling tonnage, as I explained in my former letter, I don't think the pool system has the best of it. As there is a limit to the economical tonnage that may be hauled, there was the last straw that broke the camel's back, and the last ton which caused delay, and we believe this last ton is too often added.

Mr. Leach says the "pool system will increase the operating expenses." Mr. Whelan says, "It is a measure not calculated to produce reduced expenses in the mechanical department."

And our superintendents of motive power say the cost of doing locomotive repairs must not exceed former years; and the engineers say the engines don't belong to them; that they can't make a record; that no one takes an interest in the engine—and why should they? And the Traveling Engineers' Association are out with a circular letter to find means of locating the responsible engineer, in case of neglect or misusage. And we say we are at sea in a storm, without a rudder or a port in sight. And the transportation department say the system is a good thing; push it along. So we would like to have the gentlemen who have advocated the system get in with some facts and figures to substantiate their statements, or admit that the pool system successfully operated, that they were talking about, was on a road where there was but one engine and one crew.

DAVID DAVIS.

The Gold Car Heating Company and the Gold Street Car Heating Company report that the number of orders which they have taken during the past few months are of such magnitude as to surpass all the former records of the companies. It is a certainty that the improved Gold Electric Heaters have struck a popular chord among railway officials. Prominent among the orders for electric heaters which have been taken recently, is one from the Boston Elevated Railway Company, formerly the West End Street Railway Company, of Boston, which has awarded the contract for electric heaters for their 100 new cars to the Gold Car Heating Company.

There are a great many rumors in the air to the effect that Mr. Sloan, lately president of the Delaware, Lackawanna & Western, was very much dissatisfied with the changes of officials made since he resigned, and that he was trying to secure a controlling interest in the road, with a view of changing things back to the condition they were in before he resigned. We have the best of reasons for knowing that these rumors are without foundation. The writer heard Mr. Sloan say that the changes had been necessary, and that he was perfectly in accord with the policy of the new management.

"What the Clipping Agent Found about the New Baltimore & Ohio" is the title of a very handsome pamphlet issued by the Baltimore & Ohio press department. The able press agent, Mr. J. H. Maddy, took rather a unique way of bringing it to the attention of the press. In a note circular sent out with the pamphlet, he says: 'This pamphlet is issued as a 'guarantee of good faith and not for publication.' It is particularly desired that no mention be made of it in your columns, and it will be a personal favor if, so far as the public prints are concerned, its existence be totally ignored." We have not followed the advice to ignore the circular, and we have read it with a great deal of interest. Others will find it good reading.

The International Correspondence School, of Scranton, Pa., is sending out a notice of special privileges which will be given to those who enroll before October 1st. Those of our readers who are thinking of joining the school should lose no time in sending for circular describing the special privileges of this school.

A very handsome illustrated catalog has recently been issued by the Joseph Dixon Crucible Company, Jersey City, N. J. It contains illustrations of the numerous graphite products handled by the company, and will be found a useful reference for those likely to be ordering the products referred to therein.

The Atlantic Brass Company, 192 Broadway, New York, have bought 2½ acres of land in Jersey City, very conveniently situated near the tracks of the Central Railroad of New Jersey and of the Pennsylvania Railroad. The intention is to begin at once the erection of a plant with facilities for making cast-steel castings and all sorts of brass castings. The "A. B. C." bearing is working its way so rapidly into the favor of railroad men that the company handling it have been compelled to extend their facilities, and the New Jersey works have been the outcome.

"Oilcanology" is the name of an illustrated pamphlet issued by the M. & S. Oiler Company, Denver, Colo., to illustrate and tell the good points about the oil cans manufactured by the firm named. The pamphlet bears the finger marks of John A. Hill, and consists of five little talks, which tell all that anybody needs to know about oilers. If all our readers would send for this pamphlet and study its contents, we feel certain that there would be a very decided reformation in

"oilcanology" in the near future. There are few details concerning the leakages of railroad incomes that deserve more attention than those that drop from the oil can.

The Bullock Electric Manufacturing Company, of Cincinnati, O., have favored us with Bulletin No. 4534, on engine type generators. These bulletins are interesting to mechanics generally, as they give a good idea as to the construction of modern electrical apparatus. Dimensions are also given, so that the space occupied can be determined in making plans for new machines.

The demand for the fine tools made by the L. S. Starrett Company, of Athol, Mass., has been so great lately that they have been compelled to give up the manufacture of milling cutters, and they have sold the stock, machinery and good will to Mr. F. J. Gay, who has been for the last five years a partner in this branch of their business and manager of it, and to Mr. E. T. Ward, who, under the firm name of Gay & Ward, will supply manufacturers and the trade with anything needed in the cutter line.

A special illustrated catalogue has been issued by the Chicago Pneumatic Tool Company to show up the fine array of tools that were exhibited at the Master Car Builders' and Master Mechanics' conventions at Old Point Comfort in June last. It contains twenty-eight pages of the second standard size, and is very lavishly illustrated with fine half-tone engravings, which are made from photographs taken on the ground or in the shops when the tools were at work. The pictures tell a story of labor-saving methods that would take many words in writing to relate. It will pay you to send for special edition No. 8.

In the course of a speech made before the New York Press Association, Mr. George H. Daniels, general passenger agent of the New York Central, said: "Forty-seven years ago there was issued an annual pass over the Central Line of railroads, between Buffalo and Boston, and by the People's Line of steamboats to New York, this pass bearing the following signatures on the back thereof: Ezekiel C. McIntosh, president Albany & Schenectady Railroad Company; Erastus Corning, president Utica & Schenectady Railroad Company; John Wilkinson, president Syracuse & Utica Railroad Company; Henry B. Gibson, president Rochester & Syracuse Railroad Company; Joseph Field, president Buffalo & Rochester Railroad Company; William H. Swift, president Western Railroad Company; Isaac Newton, People's Line Steamboats; Job Collamer, Watertown & Rome Railroad Company."

The Brooks Locomotive Works have lately turned out for the Illinois Central some twelve-wheel engines that are probably the heaviest in the world. The cylinders are 23 x 30 inches; drivers, 57 inches diameter. The total weight of the engine is 218,000 pounds.

The Russian Government have lately been receiving bids for the building of locomotives for railways in China. The Russian builders of locomotives are too busy to bid on this order, and it is expected to be secured by some American builder. Most of our builders have agents there trying to obtain the order.

The Brotherhood of Railroad Trainmen have determined to remove their headquarters away from Peoria, and several towns are trying to secure the general offices of that organization. Among the candidates we hear of Cleveland, Pittsburgh, Cincinnati, Chicago and Cedar Rapids.

The latest field for American locomotives is in Tunis, in North Africa. The Compagnie des Phosphates et du Chemin de Fer de Gafsa (Phosphate & Railroad Company of Gafsa) is in the market for all kinds of railroad machinery. The address of the company is 60 rue de la Victoire, Paris; cable address, Compagnie Gafsa.

"What's This?" is the name of an illustrated leaflet recently issued by the Ajax Manufacturing Company, of Cleveland, Ohio, to advertise their 1½-inch single bolt cutter. They do not give any description of the machine, but merely wish to intimate that they are now in a position to furnish bolt-threading machines of a type far in advance of any heretofore made.

The Lehigh Valley Railroad Company have just issued a book on summer tours, which will be found very interesting reading, especially for those who are expecting to go out for a summer holiday. The pamphlet can be obtained on application to Chas. S. Lee, G. P. A., 26 Cortlandt St., New York.

An announcement from the secretary of the American Railway Master Mechanics' Association and the Master Car Builders' Association intimates that the office of these associations has been changed to 667 Rookery.

The secretary of the Western Railway Club, of Chicago, has done something that is well worthy of imitation by other clubs. He has had all the monthly proceedings for 1898 bound in one volume, which has been sent to all the members.

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AMERICAN LOCOMOTIVE SANDER COMPANY,

N. E. CORNER THIRTEENTH AND WILLOW STS.,

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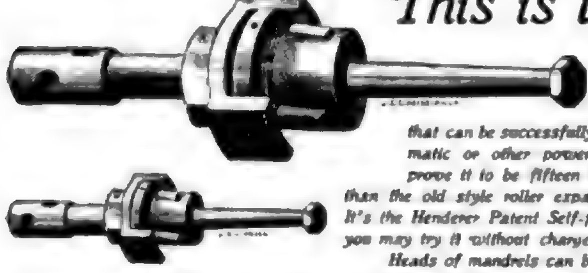

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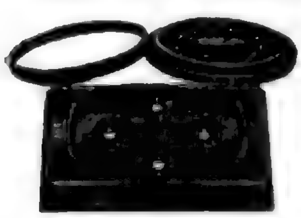

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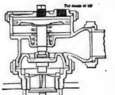

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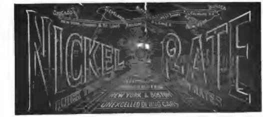

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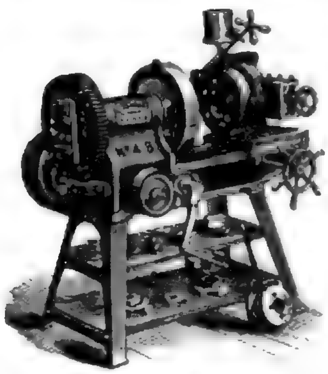

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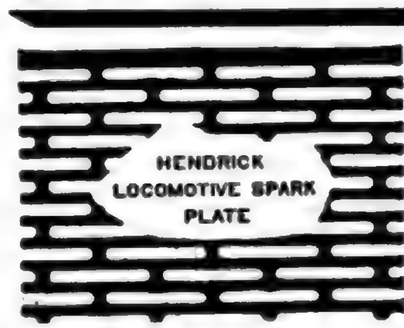

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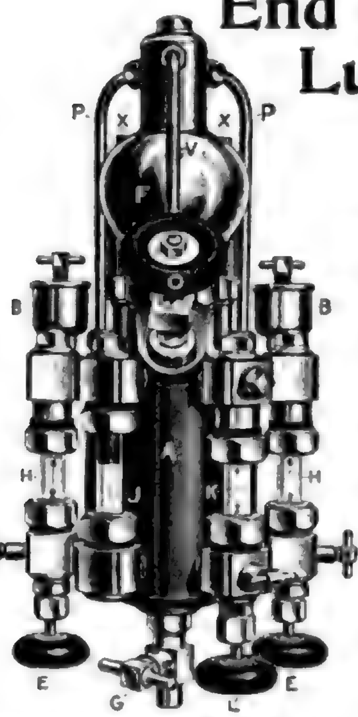

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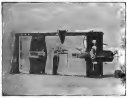

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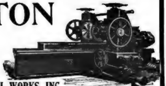

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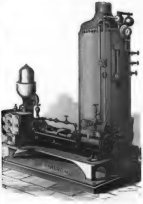

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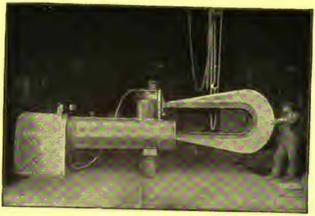

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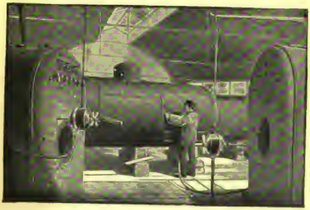

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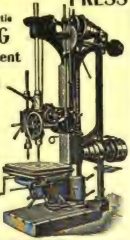

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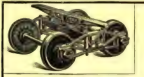

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Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XII | 95 Liberty Street, New York, October, 1899 | No. 10

The Lackawanna's New Consolidation.

The annexed illustration shows a remarkably well designed heavy consolidation culm-burning locomotive built recently in the shops belonging to the Delaware, Lackawanna & Western at Scranton, Pa. According to Mr. J. W. Fitz Gibbon, superintendent of motive power, the engine was designed and built by Master Mechanic David Brown. It is an unusually powerful engine, and will be used for the mountain service of the road.

The cylinders are 22 x 30 inches, steam ports 1½ x 20 inches, and exhaust port 3 inches wide and same length as steam ports. The driving wheels are 57 inches diameter, working pressure of boiler is 200 pounds, which gives the engine 43,305 pounds tractive force. The total weight is 197,650 pounds, in working order, of which 175,500 pounds are on the driving wheels. The firebox is 10 feet 6 inches long and 9 feet wide. The boiler is 74 inches diameter at the smallest ring, and contains 413 2-inch tubes, 13 feet long. The grate area is 95 square feet, and the total heating surface 3,002 square feet, of which 211 are in the firebox. The bearings are all of very liberal size, the driving wheel journals being 9 x 11½ inches; main rod, steel, channel type, 10 feet 7 inches long. The engineer's cab is 10 feet 4 inches wide, and the center of the boiler is 6 feet 11 inches above the head of the rail. The total wheel base is 23 feet 11½ inches, of which 15 feet 6 inches are rigid. The length of engine and tender is 57 feet 7 inches.

Among the equipment are: Gould automatic couplers front and back; two No. 11 Monitor injectors; two 3-inch Ashton safety valves; lubricator, Nathan type; Star headlight; Utica steam gages; brake, Westinghouse-American type; Latrobe tires; Marden tender brake beams; journals, "Magnus" metal; springs, National Railway Spring Company; valves, Allen-Richardson type, ⅞-inch lap; Jerome's metallic packing; carbon boiler steel; Snow's bell-ringer; Leach's sanding device; Keasbey & Mattison magnesia boiler covering; main driving wheel centers cast steel, made by Pratt & Letchworth.

LACKAWANNA'S NEW CONSOLIDATION.

Mr. A. M. Waitt, superintendent of motive power of the New York Central, is experimenting with a form of magnesia lagging for locomotive boilers, which has artificial air cavities throughout the boards of pressed magnesia. As it is the minute cells in the magnesia which make that material such a good non-conductor of heat, Mr. Waitt believes that artificial cells would make the material still better, and that is the idea that he is working on.

The Urbana Shops.

A representative of Locomotive Engineering visited the new shops of the Peoria & Eastern division of the Cleveland, Cincinnati, Chicago & St. Louis Railway at Urbana, Ill., which are in charge of Master Mechanic John McClurg, and noted many points of interest, in the general plan as well as the extremely neat appearance of everything.

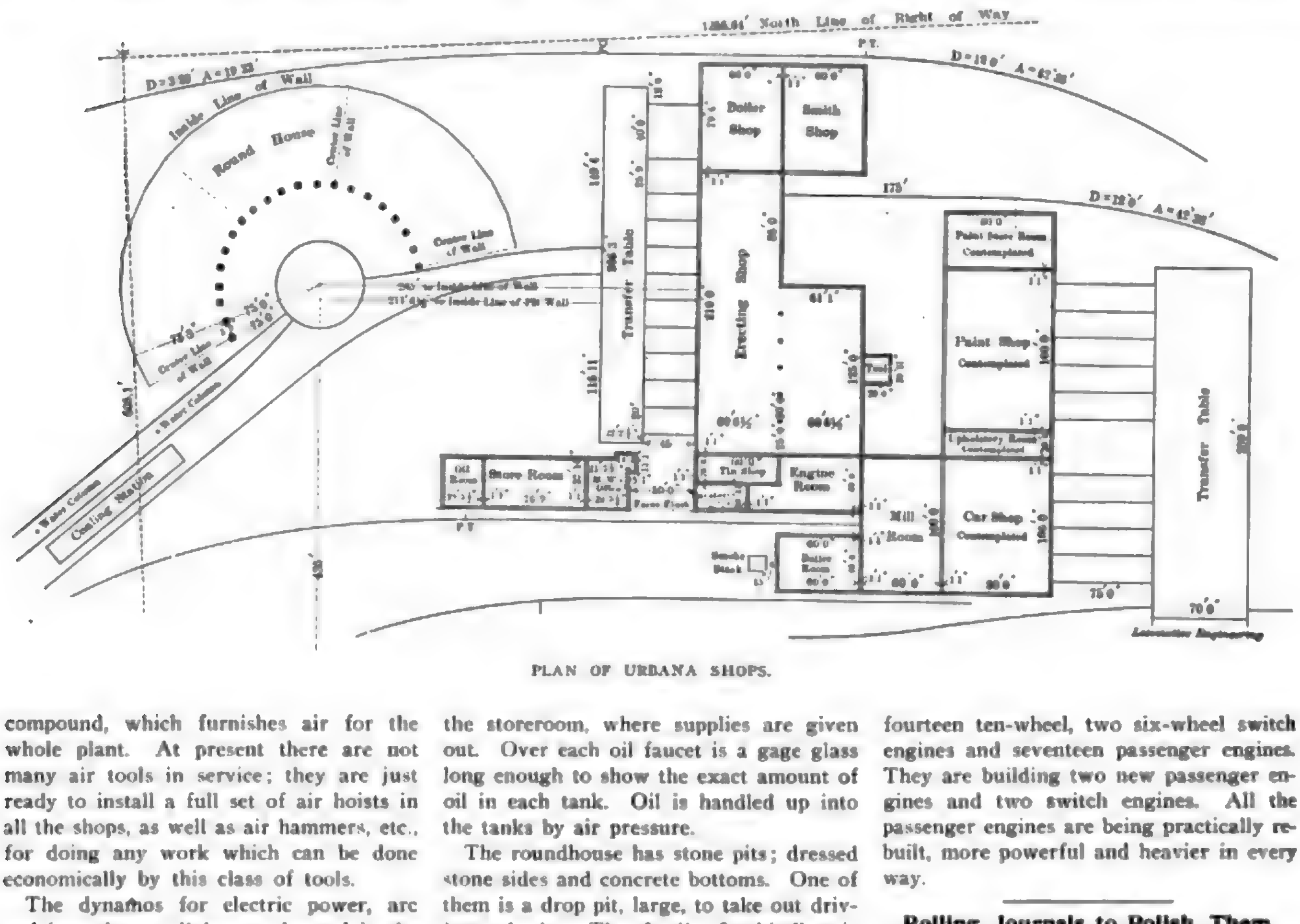
These shops are fireproof, being built of brick with steel truss roofs covered with slate, plenty of side windows as well as large windows in the roof, which give plenty of light. They are all neatly whitewashed inside. All the floors are of concrete, excepting in the blacksmith shop and engine house, where cinders are used.

The main building, 330 feet long by 120 feet wide, has the engine room, 40 feet wide, and the tin shop and a large lavatory with water closets, which takes up the width across the end of the building at the south end; then come the erecting shop, 210 feet long by 60 feet wide, having ten pits; the machine shop, 60 by 125 feet, under the same roof and next to the erect-

ing shop. At the north end is the boiler shop, 80 by 60 feet, with blacksmith shop adjoining, 80 by 60 feet, with two pits. Buffalo forges with underground flues are used in the blacksmith shop. A large revolving rack, such as we see in machine tool rooms, is used here, conveniently located so it can be easily reached from any part of the shop.

A transfer table, operated by electricity, serves the twelve pits in the erecting and boiler shop.

The main shop is heated with hot air, steam heated, furnished by a Buffalo forge fan located in the engine room, driven by an independent engine.



PLAN OF URBANA SHOPS.

In the engine room is also located the air compressor, an Ingersoll-Sergeant compound, which furnishes air for the whole plant. At present there are not many air tools in service; they are just ready to install a full set of air hoists in all the shops, as well as air hammers, etc., for doing any work which can be done economically by this class of tools.

The dynamos for electric power, arc and incandescent lights are located in the engine room, each with its own engine.

The boilers, three in number, are in a separate building next to the engine room. Only one of them is used in warm weather: all are busy in winter time. A mechanical stoker is to be installed for these boilers, which will use a low grade of slack coal and reduce the fuel bill.

The roundhouse of twenty stalls is heated with steam and lighted with electricity, as are all the buildings, by either arc or incandescent, as is most desirable. A telephone service connects them all with each other and the main office. To ensure a quick response from the roundhouse foreman, the telephone in his office has an air whistle which is operated by the telephone battery, and blows continuously, when this office is called up, till the call is answered. The whistle can be heard at any point of the house, even if engines are blowing off, which is not the case with a telephone bell. While we are on the question of noise, it is well to mention that the flue rattler is down underground near the boiler shop, so that it does not interfere with the work of the shops.

The oil room, store room and main office are in one building, midway between the main shop and the engine house, which is as near fireproof as such a building can be made. The oil is kept in eight large tanks of 2,000 gallons capacity, with oil pipes running through the wall into the storeroom, where supplies are given out. Over each oil faucet is a gage glass long enough to show the exact amount of oil in each tank. Oil is handled up into the tanks by air pressure.

The roundhouse has stone pits; dressed stone sides and concrete bottoms. One of them is a drop pit, large, to take out driving wheels. The Leslie fire-kindler is used.

The pumping station is close to the roundhouse on lower ground, where they get an ample supply of good water, which is forced up into a tank of 100,000 gallons capacity, elevated on steel framing high enough to give a good pressure for washing out, and fire protection in case any is needed. As all the shops and tracks are located on high ground near a stream, the drainage and sewerage are of the best.

At the coal chutes, link belt conveyors are used. One of them elevates the coal, another the sand from the ground floor, where it is dried and sifted, to a high bin, from which it can be run into the engine sand boxes. One conveyor handles the ashes from the cinder pit into gondolas.

The old buildings have been made over into car shops. All the new work and heavy repairs, both passenger and freight, of the division are done here. About four new cars for the passenger equipment are built here yearly, which keeps their passenger rolling stock up to date. New freight cars are also under way.

New coach shops, a paint shop and store rooms for paint and upholstery are contemplated just east of the main shop. The building for the wood mill is finished. Altogether, for the amount of rolling stock on this division, the shops are complete.

There are sixty-five engines on this division, thirty-two of them consolidated, fourteen ten-wheel, two six-wheel switch engines and seventeen passenger engines. They are building two new passenger engines and two switch engines. All the passenger engines are being practically rebuilt, more powerful and heavier in every way.

Rolling Journals to Polish Them.

The question has been raised in regard to the use of the roller in finishing up car and engine journals, that as soon as they get very hot, from any cause, the skin of iron on the surface which has been compacted and made more dense by the roller, will resume its original shape, and this will leave the journal in worse condition than if it had never been rolled.

There may be something in this as a theory, but those who roll journals as a steady thing say that the journals come back to the shop (when wheels are changed) in better shape than those not rolled, and so far those who roll them seem to have the best of the argument.

BROOKS DENVER & RIO GRANDE TEN-WHEELER.

Brooks Rio Grande Ten-Wheeler.

The particularly handsome ten-wheeler shown is one of a group recently built by the Brooks Locomotive Works for the Denver & Rio Grande Railroad. The engines seem to be as efficient specimens of powerful motive power locomotives as anything which we have examined since the tendency towards maximum capacity in engines of this character has become the question with locomotive builders.

The general dimensions of the engines are:

Weight on drivers—124,000 pounds.

Weight on trucks—36,000 pounds.

Weight, total—160,000 pounds.

Wheel-base, total, of engine—23 feet 7 inches.

Wheel-base, driving—13 feet.

Wheel-base, total, engine and tender—53 feet 10¾ inches.

Length over all, engine—39 feet 11⅞ inches.

Length over all, total, engine and tender—65 feet 10⅝ inches.

Height, center of boiler above rails—8 feet 6 inches.

Height of stack above rails—14 feet 11½ inches.

Heating surface, firebox—165 square feet.

Heating surface, tubes—2,257 square feet.

Heating surface, total—2,422 square feet.

Grate area—33.5 square feet.

Drivers, diameter—63 inches.

Drivers, material of centers—Cast steel.

Truck wheels, diameter—33 inches.

Journals, driving axle—9 x 12 inches.

Journals, truck—5½ x 12 inches.

Main crank pin, size—6¼ x 6½ inches.

Cylinders, diameter—21 inches.

Piston, stroke—26 inches.

Piston rod, diameter—3½ inches.

Kind of piston rod packing—United States.

Main rod, length center to center—115 inches.

Steam ports, length—21 inches.

Steam ports, width—2 inches.

Exhaust ports, least area—50 square inches.

Bridge, width—3¼ inches.

Valves, kind of—Improved piston.

Valves, greatest travel—6¼ inches.

Valves, steam lap (inside)—1⅛ inches.

Valves, exhaust lap or clearance (outside)—Line on line.

Lead in full gear—1-16 inch negative.

Lead, constant or variable—Variable.

Boiler, type of—Radial stay.

Boiler, working steam pressure—210 pounds.

Boiler, thickness of material in barrel—¾ inch.

Boiler, thickness of tube sheet—⅝ inch

Boiler, diameter of barrel—68 inches.

Firebox, type—Long, over frames.

Firebox length—121 inches.

Firebox width—41 inches.

Firebox depth, front—79 inches.
Firebox depth, back—68 inches.
Firebox material—Steel.
Firebox, thickness of sheets—Crown, 3/8 inch; tube, 1/2 inch; side and back, 3/8 inch.
Firebox mud ring, width—Back, 4 inches; sides, 4 inches; front, 4 1/2 inches.
Firebox, water space at top—Back, 5 inches; sides, 6 inches; front 4 inches.
Grates, kind of—Cast iron rocking.
Tubes, number of—326.
Tubes, material—Charcoal iron.
Tubes, outside diameter—2 inches.
Tubes, thickness—No. 11 B. W. G.
Tubes, length over tube sheets—13 feet 3 13-16 inches.

Boring and Finishing Cylinders in the Horwich Shops of the Lancashire and Yorkshire Railway.

Having given a general account of the Lancashire & Yorkshire Railway shops at Horwich in previous issues, it now remains for me to close the story with an account of a special machine shop operation carried on there which differs in some respects from any other I have seen elsewhere.

We have in previous issues given accounts of the practice of a number of our American shops in finishing cylinders. The methods pursued at Horwich differ radically from any that we have shown, and in fact from any American practice; primarily, of course, because the cylinders are so totally different in design that the methods followed with our cylinders would be inapplicable to theirs. Our shops have in many cases developed their cylinder finishing methods "to the limit," but I believe an inspection of the accompanying drawing of a pair of 18 x 26 inch cylinders for a freight engine and the photographs illustrating its progress from a mere casting to a finished piece, ready to take its place as one of the most important parts of a locomotive, will prove interesting, and show that Mr. Aspinall has gone about as far as it seems possible to go in facilitating the various operations and in avoiding the possibility of anything going wrong during the process.

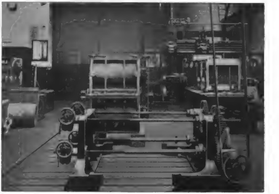


FIG. 31. BORING MACHINE FOR PISTON AND VALVE ROD HOLES.

The drawing, Fig. 30, shows the construction of the L. & Y. standard cylinders very clearly. The plate-frames are bolted to this casting, one on either side, as shown in the view at the lower left-hand corner of Fig. 30, and the boiler is attached to the same casting by the lower edge of the flanged head, which is best seen in Fig. 28, July issue, page 306, and which is fastened by bolts to the seat provided for it, which seat is shown at the extreme upper right-hand corner of Fig. 30 and also in the plan view at the lower center of the same figure.

The cylinder then goes to the machine shown in Fig. 31, which has four boring-bars and on its base planed seats, into which the planed cylinder fits and is thus surely located precisely both vertically and laterally—without the possibility of a mistake. The four bars then bore simultaneously the four holes for the piston rods and valve stems and for their stuffing-box glands. The machine is very simple and has evidently been designed and built solely for this particular work. The feed is by means of a thread cut on the bars themselves, and though I do not certainly remember the exact construction, I think there is a nut which is released and allowed to revolve with the bar when not feeding and is held from turning by a suitable clamp when the feed is desired. The small hand-wheels probably rotate the nut for hand movement of the bars, as in setting a cut, or running back. The cylinders when in this machine rest upon and are located vertically by the previously planed bosses for the cylinder cocks.

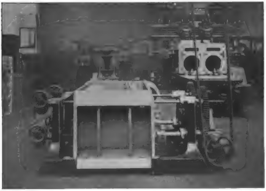


FIG. 32. BORING MACHINE AT WORK.

The next operation is to bore the cylinders proper, which is done on the machine shown in Fig. 33. This machine has two bars which are fixed at the correct distance, center to center, and each is provided with a sliding head having three tools. The outer ends of the bars run in bushings which are inserted in the previously bored holes for the stuffing-box glands, as shown in Fig. 34, where a pair of cylinders are shown in process of boring. It will be noticed that by this arrangement the cylinders themselves form the outboard bearing for the boring bars and the machine is reduced

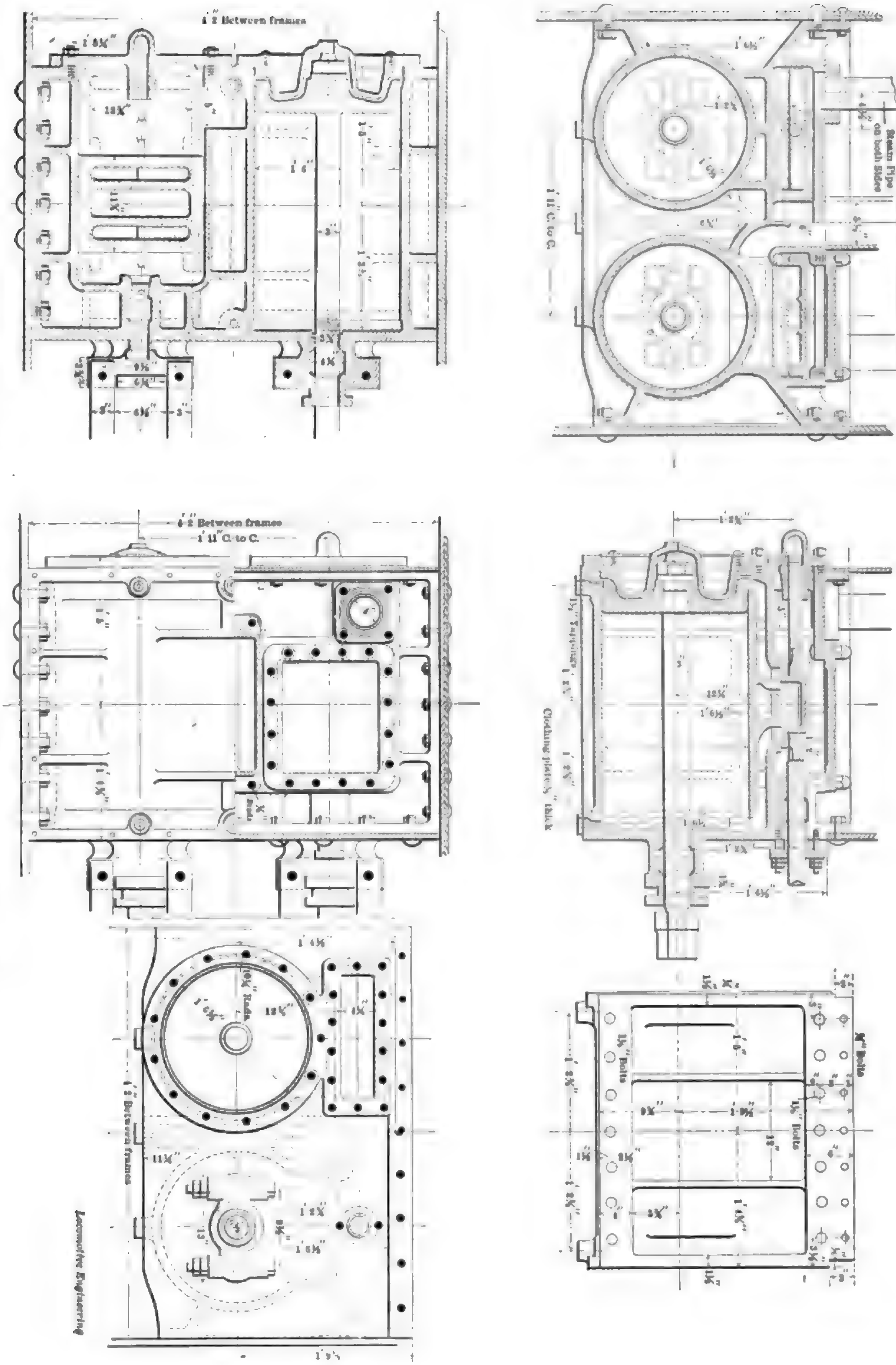


FIG. 30. STANDARD 18 x 26-INCH CYLINDER, LANCASHIRE & YORKSHIRE RAILWAY.

to the simplest possible elements. The lower bar is driven by worm gearing and the upper one by spur gears from the lower. The feed mechanism is by the familiar star device.

In the lower left-hand corner of Fig. 34 is seen a portion of another boring head not in use. It will be noticed that the slots for the cutting tools are not put in radially, as is too often done in our own shops, apparently under the mistaken notion that such a head is really a milling cutter; and the further mistaken notion that, therefore, the tools need no top rake, but can as well push and jam off the metal instead of cutting it, as they, of course, should do. Why our boring heads are so often made with radial slots for the tools, and then time and patience expended in grinding hollows on the top faces of the tools to give them rake and a cutting edge, is to me an unfathomable mystery. Made as shown in this view no grinding needs to be done except upon the ends of the tools where only it should be done.

At Fig. 35 is the final operation of drilling, tapping and studding. The machine in this case is by Wm. Muir & Co., of Manchester, and the tapping and stud screwing device shown in use is, I think, made by Smith & Coventry, of the same place. Its principle of action is to drive by means of an interlocking clutch with the locking faces made at such an angle that they would force themselves apart were it not for the pressure of the helical spring shown, which holds them together until by the bottoming of the tap or stud the resistance becomes abnormal, when the clutch is allowed to slip. The valve-face and ports seen in Fig. 35 are milled upon a vertical spindle machine, of which I have no photograph.

The processes here outlined may be said to be in the reverse order of the usual machine shop practice in finishing cylinders, the boring being almost invariably the first operation and all subsequent planing and other work done with reference to it. A good while ago, in an American shop, I had something to do with an elaborate system of tools for finishing the cylinders of stationary engines. They were arranged to be first bored and the counterbores were carefully gaged to standard sizes. Angle-plates were made in pairs, with disks on their vertical faces fitting these counterbores, and the tops of the angle-plates were fitted with hardened steel pieces representing the heights of the various surfaces to be planed and the exact location of all shoulders as well. The cylinders were simply rotated on these disks to the different positions required and the various surfaces planed in accordance with the hardened steel gage pieces. This outfit of tools, together with others of similar character used throughout the engine, produced strictly interchangeable parts, and in erecting no line was ever needed through the cylinder. The parts simply could not go together otherwise than right. Whether it is best to bore before planing or afterward in manufacturing cylinders is an open question perhaps, but it is an interesting fact that Mr. Aspinall makes an entire success of the operation by reversing the usual procedure. The admirable simplicity and high efficiency of the methods shown are but representative of the entire establishment. Good work is done thoroughly and it is done by very advanced methods.—Fred. J. Miller, in *American Machinist.*

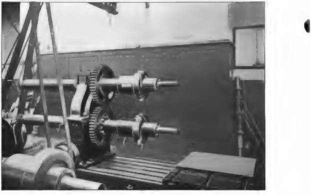


FIG. 33. CYLINDER BORING MACHINE.

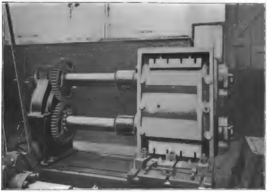


FIG. 34. BORING CYLINDERS.

An Old Fashioned Idea.

On a new ten-wheel engine built by an Eastern locomotive builder for a Western railroad we saw on the back end of the tender the same style of small, round water hole, with its cast-iron cover almost as heavy as a fireman could lift, which this works used in 1872.

We will venture to say that if the man who put this style of an opening to take water in a hurry from our modern standpipes into a tender had to make an air-brake stop for this purpose, he would want it changed to an oval hole of generous dimensions the first time he was taken off a passenger train for shaking things up in trying to get the tender spotted so the water pipe would reach the opening.

With a small, round opening the tenders, and incidentally the passenger cars,

must be stopped at a certain exact spot, or the spout will not go in where it belongs. With a large oval hole anywhere within a range of 2 feet each way from this exact place will be all right; this gives a possible range of 4 feet instead of exact to an inch.

Some master mechanics have the long way of the oval run lengthways of the tank; most of them, however, are crossways. We think the latter way is the most efficient, as it best allows for varying heights of tenders and water cranes. These small blemishes on otherwise good designs go a long ways to call down the daily wrath of the engine and train crews on a defect long ago cured by modern practice.

Water in the Air Hoists.

The use of compressed air in shop work for hoists, air hammers, riveting machines, boring machines and small engines is now so extensive that some pointers gained from observations of its work and conditions in the air brake equipment will be of interest. In the first place, water in the various pipes and reservoirs around the shops, as well as that found in the hoists which blows out of the air valves when they are operated, is a great nuisance.

It would be the same in train service if it was distributed throughout the length of the train and found its way into every brake cylinder; but the storage conditions in the air brake equipment prevent this trouble.

There is some water in the shape of vapor in the air at all times; when this air is compressed to a smaller volume it cannot hold all this water as a vapor. So the excess is precipitated as free water just as soon as it cools down (after compression) to the normal temperature of the outside air. On a locomotive this usually takes place in the main reservoir, which, being made of comparatively thin material and exposed to a current of cool air as the engine moves along, the heat evolved during compression radiates away and the free water is left there. If the main reservoir is too small to allow the air to cool off before it passes back to the train, some of this water will be found in the tender drain cup, and at rare occasions in the tender auxiliary. The triple valve usually has a full supply, but it is unusual to find any water in the train farther back.

Now, with a heavy demand for air caused by a very long train, or a leaky one (together with a hot pump, which is a consequence of this heavy demand), less water is found in the main reservoir and more in the train pipe and connections back of it. If this is the case in cold weather it is liable to freeze up the triple valves, and is dangerous. This emphasizes the fact that the main reservoir should be large enough to cool off the air, as well as store enough for a long train, and its location on the engine should be where there will be a free circulation of air around it.

The conditions of the shop compressor, its storage reservoirs and piping radiating out to the various places where the compressed air is being used are very much different. The compressor is usually located in a hot engine room, and taking its supply of free air from there, together with the vapor from the steam which escapes there and is mixed with the air, the air goes to the main reservoir very hot. If this reservoir is located in the corner of the engine room, for convenience of piping, the air does not cool off there, and very little water will be found in it. It passes on to the supplementary reservoirs in the other buildings, and cools off later. If the pipe from the compressor to the machines is coupled to the reservoir with a tee, it is then a storage reservoir only, and the water will pass along to the machines. But if the air goes into the reservoirs at one end and out at the other, it is a cooler also; quite a difference for the machines that use the air.

The argument is used that the loss of heat from compressed air means a loss of power, or else there would be no gain in reheating it just before it is used in engines for transfer tables, motors for street railways, etc.

If this is granted, it would require the lagging and boxing of all reservoirs and pipes to the same extent that live steam pipes need it; this is obviously impracticable in our shops. One of the advantages of compressed air in shop work is the fact that it does not freeze up nor condense and lose its expansive power when carried in piping, as steam will do. As long as it is likely to cool off before being used, the sooner it can be cooled off the less difficulty will be experienced with water in the pipes and coming through the machinery we use it in. If we take the view that this water passing along to the machines is a disadvantage which should be overcome, then a cooler which will take the heat from the air as soon as it comes from the compressor, and operates to stop the water there, will be an advantage.

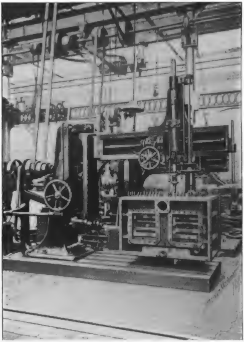


FIG. 35. DRILLING, TAPPING AND STUDDING

Richmond Locomotive for Swedish State Railways.

The half-tone of the six-wheel connected side-tank locomotive hereby shown is one of ten recently built by the Richmond Locomotive Works for the Swedish State Railways. It is intended that they should work north of the Arctic Circle. The engines have no bells, and the handles for operating the engines are placed on the left-hand side, which is a fashion on Swedish State railways. With these and a few other changes, the engines are essentially of the American switching type, the arrangement of boilers, cylinders, frames and running gear being American in almost every detail.

The cylinders are 15 x 22 inches, and the driving wheels are 48 inches diameter. As the boiler carries 165 pounds pressure, the tractive force of the engine is about 14,463 pounds. The ratio of weight to adhesion is 5.12. The weight of the engine in working order is 75,000 pounds. The wheel-base is 12 feet.

Richardson balanced slide valves are employed, and they have maximum travel of 4½ inches, with ¾-inch outside lap, 1-32 inch inside. The boiler is straight and is 47 inches diameter in smallest ring. The firebox is of copper and is 55⅛ inches long and 34 inches wide. There are 146 2-inch tubes, which, with the firebox, give 868 square feet of heating surface. The engines have Nathan lubricators, United States metallic packing, Latrobe tires, French springs, Monitor injectors, Coale safety valves, Star steam gage and magnesia sectional boiler covering.

RICHMOND LOCOMOTIVE FOR SWEDEN.

Mechanic's Pocket Memoranda.

The Cleveland Twist Drill Company, Cleveland, Ohio, have favored us with a copy of the "Mechanic's Pocket Memoranda." This neat and valuable little handbook was issued by the International Correspondence Schools, and the Cleveland people are to be congratulated on having secured such a valuable book to send to their friends.

Beside the usual tables of areas, circumference, squares, cubes, etc., there is a large amount of practical information which any mechanic is liable to need at any time. The problems are illustrated by examples worked out, and numerous engravings help to make the text clear.

There are 318 pages of mechanical and electrical matter that is sure to be useful to any mechanic, and we advise any of our readers who want a first-class pocket-book to write the Cleveland Twist Drill Company for terms at which they can be secured.

The seasoning of timber by means of electricity has passed from the experimental stage to one of assured success. The stick to be treated is immersed in a solution containing 10 per cent. of borax, 5 per cent. of resin and ¾ per cent. carbonate of soda, the borax being used on account of its antiseptic properties, and the sodium carbonate to assist in dissolving the resin. A porous tray, the bottom of which is lined with two sheets of canvas, with a sheet of felt between, is placed over the log, and above this is placed a sheet of lead connected with the negative pole of the dynamo. The positive pole of the dynamo is connected with a lead grating, upon which the log to be treated stands. The current is then turned on and the treatment continued six or eight hours. By this simple means the sap is driven out and its place taken by the solution. The various details being thus carried out, the process is accomplished; the log is now withdrawn and seasoned by drying, which requires, under favorable circumstances, a period of several weeks.

Bombay has a railroad which is used in connection with the sanitation of the town. According to *The Engineer*, it is over three miles long and is intended for transporting the road sweepings to a piece of land nearly 900 acres in extent. It is considered that this tract will fulfill all requirements for about twenty-three years. The sanitary authorities have tried two systems of destructors, but both have been discarded.

General Correspondence.

All letters in this Department must have name of author attached.

Why the Locomotive Goes.

The question of a locomotive's moving is an interesting one, and while the article in September gives the facts and figures of the case, there are a few of us who can perhaps understand it better without the figures and with a few other sketches.

The fulcrum at the rail is what puzzled most of us, for, as one of the boys remarked, "You take a stick like this [Fig. 1] and push on it here [a], and the stick would go backwards. Why wouldn't the wheel roll back, too?" But we know it doesn't, and yet we know the axle isn't the fulcrum (except of rotation), as it moves along with the engine, and the fulcrum isn't supposed to move with the load.

The whole trouble comes from considering the power applied at *a* as being from an outside force instead of from the machine itself. Take Fig. 2 and just suppose yourself seated on the car, pushing the stick *b*. You wouldn't have the slightest doubt as to the way the car would move. Yet if you stood on the ground and pushed the stick *b*, the car would move from you. If you doubt it, try it with your boy's express wagon, or even with the baby carriage.

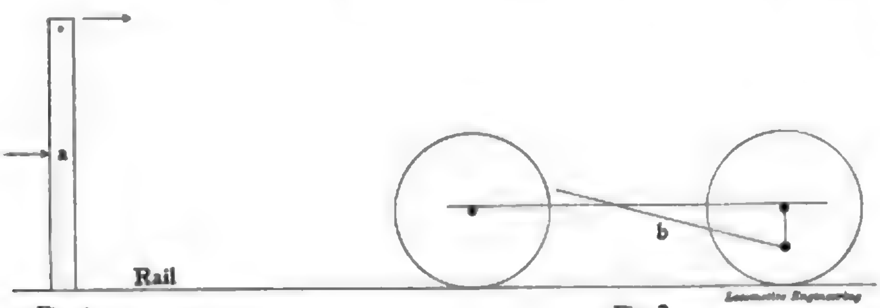


Fig. 1 Fig. 2

The trouble comes from confusing the rotation or revolution of the engine with its advance along the rails. The fulcrum of rotation is the center of the axle; the fulcrum of movement along the rail is at the rail itself. I could multiply cases and examples, but this ought to do—it satisfied most of the boys around here.

Then, too, the statement that the piston is at rest *with the ground* at each end of the stroke, is a weak point. As far as I can see, the only time it can be at rest with the ground is where the *backward* travel of piston equals *forward* travel of engine. This can only occur when the stroke of piston equals half the circumference of driver, and this is only found in a geared engine, for the crank must equal one-quarter the circumference, which would always place it outside the rim of a wheel. The author probably meant to say that the piston was at rest, with reference to the engine, at each end of the stroke.

I. B. RICH.

Honeybrook, Pa.

The Time Element in Tonnage Rating

While I do not, as a general proposition, believe in prolonged discussions, I trust you will allow me sufficient space to reply to one of the points raised by Mr. Geo. Hodgins in his article on "the ton-mile per hour," appearing in your September issue.

In commenting on the method in use on the Chicago Great Western Railway, explained in your July issue, Mr. Hodgins, while admitting the method to be a good one, apparently is still of the opinion that it does not embrace the time element in its entirety. As stated in my previous letter, the most essential factor in the question of comparative fuel records of individual enginemen is the basis or allowance of coal per ton-mile of total train. If in computing individual records the Chicago Great Western Railway were to deal with the *gross* amount of coal used from the time the engine left the roundhouse before starting, until housed after arrival, and had but one allowance per 10,000 ton-miles for freight or other trains, irrespective of the service engaged in, I would be willing to admit that the method described by me would be more correct and fair to the men were it to embrace the time element as advocated by Mr. Hodgins.

Such, however, is not the case. With the Chicago Great Western method, mail, express, suburban, stock, time and way freight trains have each a different allowance which varies according to the division and direction of train. Moreover, the amount of coal dealt with as "used" is the amount used in actually hauling the train. In addition the men's records are compared by division only; that is to say, the record of a man on one division is not compared with those on a different division.

Mr. Hodgins, in speaking of the Chicago Great Western method, says, "We have then x tons of coal used in moving a train of certain tonnage over such and such a distance in a known direction. But the same amount of coal may be burned in making the same tonnage in double the time of the first, and this method does not have at its disposal any means of differentiating the performances. We have two engines doing the same work, but at different speeds."

This quotation from Mr. Hodgins' article proves to me that he does not fully understand the method used on the Chicago Great Western Railway. If he did he would realize that they have the very thing he claims they have not, viz., the means of differentiating the performances. This for the reason that owing to the fact that the allowance of coal varies according to *division, direction and class of train handled;* and inasmuch as the amount of coal dealt with as "used" is that consumed in actually hauling the train, the comparison is in reality between men doing similar work on the same schedule of time.

To make my meaning clearer, we will assume engineers A and B are hauling time freight trains from and to the same point, moving in the same direction, the running time being twelve hours. Engineer A makes the run in thirteen hours; engineer B in seventeen hours. Both are late—A one hour, B five. The delay to both trains in nine cases out of ten will be found to be due to such causes as meeting and passing trains, switching, stopping for meals, defective cars, engine failures, etc. For these delays the individual records of A and B receive credit in the form of coal at the rate of 50 pounds per hour for standing still and 500 pounds per hour for moving. Consequently the amount of coal dealt with as "used" in both cases is the amount used in actually hauling the train on practically a twelve-hour schedule. The same applies to other classes of trains, and inasmuch as each class is practically on a running schedule of its own, the time element is well taken care of.

While it is possible—as far as the leaving and arrival time of a train is concerned—for one man to cover the same distance in half the time another man will, it is hardly probable, after the detentions, etc., have been eliminated from the trip, that one man will be found to be able to make the trip in half the time occupied by the other, both running trains of the

same class. If such a condition of affairs is possible, there must be something radically wrong with either the running time, the engine or the enginemen.

In conclusion, would say I do not wish to be understood as taking the position that the time element is not essential in this matter, but rather that the Chicago Great Western Railway have allowed it to enter into their fuel records of individual enginemen since 1894, and, I contend, in a more simple and practical form than that advocated by Mr. Hodgins.

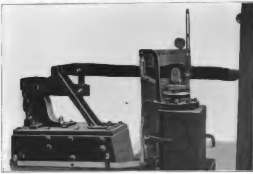
It should be realized that economy in fuel is brought about principally through the intelligence and co-operation of enginemen. Therefore the more simple the records the more accurate is it possible to keep them and the more readily and clearly are they understood by the men. I may be wrong in this matter, but, in my opinion, were managing officials, when trying to economize, to realize that every man from the section hand up is a more or less important factor in the operation of the road, American railways would, as far as operation is concerned, be on a more solid basis than the majority of them are to-day. It is an easy matter to reduce operating expenses for the time being by slashing right and left, but to bring about and maintain an economical operation, the co-operation of the men must be obtained. The official who does not, or will not, realize this fact cannot maintain for any length of time an economical operation in the proper sense of the term.

JOHN H. GOODYEAR.

Home Made Punching Machine.

There is a very decided tendency among the head motive-power officials of Southern railroads to put the blue pencil mark through requisitions for tools sent in by the master mechanic. The consequence of this policy is that repair shops in the South are full of improvised devices for curtailing the labor account. The punching machine shown came forth under the kind of pressure referred to. It is to be found at work in the shops of the Louisville & Nashville Railroad at Mobile, Ala., and was gotten out by Master Mechanic Minto and his assistants. As far as we can make out, there was as much personal combination in the work of designing the tool as there is in the tool itself.

The tool does its work by a combination of air pressure and leverages, and it is so powerful that it punches a hole through a plate 1 inch thick. The details of design can easily be understood by an inspection of the engraving. The guide to the right of the picture holds a spiral spring which takes up the shock that follows the punch pushing through the plate. The air cylinder is an old air-brake cylinder, and all the other parts represent very small expenditure of time or money.

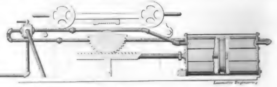


PUNCHING MACHINE.

Welding Machine Operated by Air.

The illustration shows an air appliance which has been attached to the Debombourg welding and upsetting machine used in the Erie shops at Galion, Ohio. The machine was originally operated by a lever 7 feet long, and required from one to four men to operate it. It is now operated by the valve shown in sketch. The cylinder is 12 x 27 inches, and has a rack on the end of piston rod. This is connected to a segment of a gear on the end of the eccentric shaft.

This appliance was gotten up by Mr. A. A. Arnold, machine foreman, under the supervision of Mr. A. W. Ball, master mechanic, and is one of the many air appliances used in the Erie shops at Galion, Ohio.



AIR APPARATUS FOR WELDING MACHINE.

Adventures of an Engineer in Tropical America.

BY W. D. HOLLAND.

THIRD LETTER.

In your May number my readers left me sailing down the Mississippi River *en route* for Central America, and I was nearing the Gulf of Mexico, about 112 miles from New Orleans. The scenery on both sides was charming, affording occasional glimpses of sugar and rice plantations until near Fort Jackson we were in sight of the battle fields where the Americans fought the English in 1812—certainly a point of interest for a patriotic American.

Captain Gault, of the "Stillwater" and I soon became friends, and he called my attention to the various points as we passed along the Louisiana shore. At Port Eads, the mouth of the river, we made a short stop to leave our pilot, and as we entered into the mighty Gulf of Mexico I gave one last look northward towards the vanishing shores of the "land of the free and the home of the brave," wondering if I ever should behold them again.

The sound of the dinner gong woke me from my reveries, and Captain Gault accompanied me to the saloon, where I became acquainted with several fellow passengers. Some of them were bound for Honduras, others for Jamaica, and two civil engineers had the same destination as myself. I told them of my prospects, and that the chances were they might give me the stakes. I soon learned that my new friends had a strong liking for glasses with something in them, and the thought occurred to me that if they were as proficient in staking a railroad as they were in looking into the glass, they surely must be all right.

For the following three days the weather was pleasant, and on the fourth day we dropped anchor at Belize, British Honduras, a settlement of principally negroes, whose national costume consists of a straw hat and a cigar. The heat on deck was intense and brought me to the conclusion that while this costume might

not be proper it certainly was appropriate in this climate. We landed the mail and took on some fruit, then sailed away, and the following morning we landed in Livingstone, where to my disgust I found out that a small epidemic of yellow fever was raging; so instead of going to a hotel with my friends I left at once for Puerto Barrios, across the bay, on a small boat, rowed by Carib niggers, another specimen of the African race, who have a language of their own and also boast of an uncrowned king. They proved to be good boatmen, and after dark we pulled up to a small wharf at Puerto Barrios, a small place indicated by a few lights glistening from the shore. As it was considered dangerous to land on the wharf, I was carried ashore on a nigger's back and reached *terra firma* in safety, though my friend McGruder was not equally lucky; his Carib stepped into a hole and both plunged into the water. It was not deep and quite warm; so they were none the worse for their involuntary bath, and felt refreshed and rather comfortable.

EARLY RAILROADING IN GUATEMALA. WAITING FOR TRAIN TIME.

We first visited the commissary and the office of the company—not a very imposing one either—and the agent, an Italian who spoke Spanish, prepared dinner for us and then showed us where to rest our weary limbs on the soft side of a wine cask. Mr. Pampanolla was just from Rome, and the railroad commissary was well supplied with hair oil, cosmetics and maccaroni, but not with beds. Nevertheless, I slept well on my couch of roses, and the daylight afforded me a good look of Puerto Barrios, a beautiful harbor, and along the beach a few native huts, that was all. I discovered thousands of tons of steel rails buried in the sand with the sea water rushing over them, useless for any purpose. Walking up the track I saw locomotives all covered with rust and the cabs and the woodwork entirely rotten. The seven miles of track, laid about eight years previously by the president, Rufino Barrios, could hardly be found, as all work had been abandoned since his assassination during a revolution. Thus, for eight years the fine material was left to its fate until it was unfit for use, and only lately Rufino's nephew, Reina Barrios, resumed the work and gave the contract for completing the road to Mr. Silvanus Miller, the distance from the port to the city of Guatemala being 208 miles.

After returning from my walk I presented my letters to Mr. W. Hall, chief engineer, as Mr. Miller was absent. There was no steel to lay and no men to lay it. All the Americans here were officers, including the master mechanic. On his return Mr. Miller, therefore, told Mr. Hall that I could be of more use to him repairing the old engines than laying the track. Thus, within a few days I started to work for Jimmy Garvin, formerly engineer in Mexico. This little man felt very important in his new position (his maiden position of this kind), and though there were but four of us in the shops, the numerous bulletins he would post around would make the late lamented A. D. Wilder, of California, turn green with envy.

As before mentioned the Caribs had a king to rule them, and his majesty paid frequent visits to the roundhouse, on which occasion Jimmy would show him his piles of rust with immense satisfaction. Thus I worked on for a month, occupying a small room in the roundhouse, and my evenings were spent reading or watching the niggers shoot craps. There was one character by the name of Brock whom I must not forget to mention. He used to keep up a fire in the forge for his companions to play by, and with the turning of the crank he would sing from 7 until 11 o'clock:

O Lord, O Lord, O Lord, O Lord, O Lord,
O Lord, O Lord!

then from 11 until 6 o'clock, to the same monotonous tune:

O babe, O babe, O babe, O babe, O babe,
O babe, O babe!

This was quite a feat, considering that this nigger would go through the same performance night after night and then work hard the next day in the tropical sun. To me it was quite amusing to watch him. One night when I was alone, reading as usual, Mr. Miller sent for me and asked if I should like to go into the interior as chief engineer of a line of dredges. I consented and was introduced to a Mr. Roberts, who had the contract to do this work, and after some conversation I made arrangements with him and signed a contract for five months at a salary of $200 gold a month, besides board, books and postage stamps. Well supplied with provisions, including liquid refreshments, Mr. Roberts and I started up the Graciosa and Sacramento River the

LAYING RAILS THROUGH SWAMP.

valve on that side, hold it shut until intercepting valve was moved and pressure reduced by escaping into receiver.

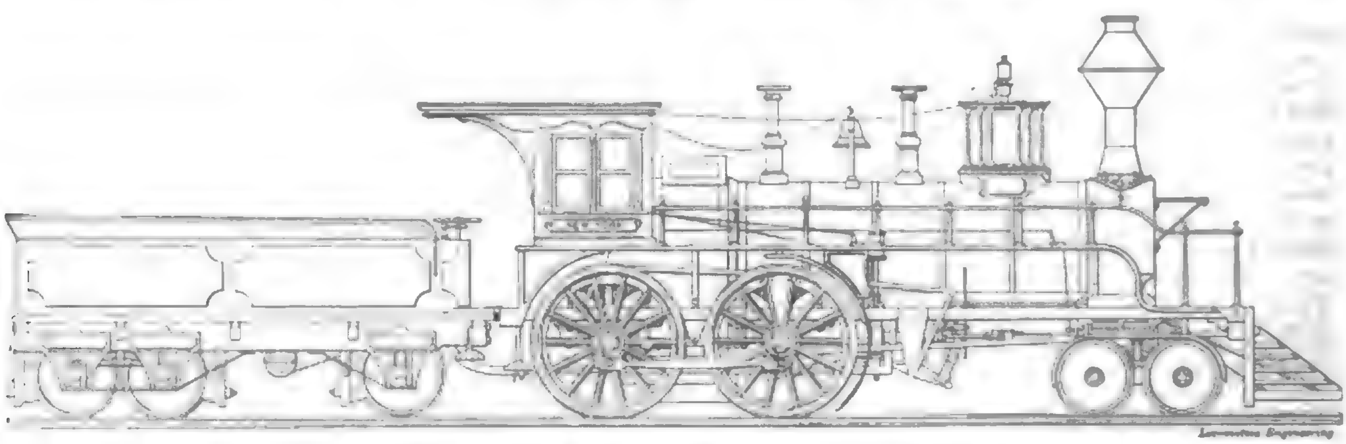
The Pittsburgh Locomotive Works recommend the following methods of operation:

No particular inspection is required by the engineer, other than is necessary of a single expansion locomotive, except to see that the drain valve at back of intercepting valve chamber is closed.

On starting his train the engineer should work engine in single expansion—two or three car lengths is sufficient—then by hooking reverse lever up one or more notches the engine is converted into double expansion. As long as the reverse lever remains in first notch, either forward or back motion, the intercepting valve will be in position for single expansion. With the reverse lever in any other position on quadrant the engine will be converted into compound, or double expansion.

As it is necessary when switching to move reverse lever frequently, and also that engine should remain in single expansion, a stop-cock is placed in steam pipe connecting boiler with reversing cylinder and within reach of engineer. By closing this cock when reverse lever is in first notch, the engine can be operated in single expansion, or as a simple engine as long as desired and at any point of cut-off.

In the event of either side being disabled, the intercepting valve should be placed in position for single expansion, or at the back end of intercepting valve chamber. If it is desired to use the right-hand, or high-pressure, side only, it will be necessary to prevent high-pressure steam from entering receiver, and, consequently, steam chest of low-pressure cylinder. To do this the reducing valve, in front of cylinder saddle, must be prevented from operating. This can be accomplished easily by removing spring, putting in its place a clamp made of wood or iron, against which the lock-nuts may be screwed, thus holding valve securely to its seat.



ONE OF THE GRIGGS ENGINES ON THE BOSTON & PROVIDENCE RAILROAD.

If the high-pressure side be disabled, and it is desired to use the left-hand, or low-pressure, cylinder only, it will be necessary to proceed in precisely the same manner as would be in the case with a single-expansion locomotive, viz.: by placing the main valve in central position, covering both steam and exhaust ports. The low-pressure cylinder would then be operated by live steam admitted through reducing valve and receiver.

The Canadian Pacific Railway, on which about fifty engines of this system are in operation, have adopted a card of instructions (a copy of which is posted in each cab for the benefit of the engineer), which reads as follows:

1. Compound the locomotive as soon as possible after starting the train; two or three revolutions are sufficient in single expansion. This is very important.

2. When climbing grades do not change the engine from compound to simple, if possible, and not unless speed gets down to less than six miles per hour, and compound again at the earliest possible moment.

3. Engineers should take care to close the throttle to some extent just before the changing from compound to simple, or the engine will slip badly before the throttle can be closed, on account of the increase of cylinder power.

4. If the engine is a two-cylinder compound, do not be deceived in judging speed by taking notice of exhausts (two per revolution).

5. Do not attempt to run the engine notched up higher than fourth notch, even when running light. Higher notching up only causes loss of steam by condensation in cylinders.

6. Always run engine in single expansion (not compound) when running without steam. If at any time this is not convenient, a little steam should be worked in the cylinders.

7. In two-cylinder compounds the greater part of the valve oil should be put into high-pressure cylinder, one drop in low-pressure to five or six in the high-pressure.

8. Great care to be taken to keep fire thin and without holes. If engine does not steam with thin fire it should be reported to locomotive foreman or master mechanic.

9. It is necessary that an engine compounded on the Pittsburgh system should move over into compound immediately on being hooked up one notch, and should move into simple on being put into corner notch. If this does not work exactly, it should be reported and attended to at once. This applies to both forward and back gear, but is most important in forward gear.

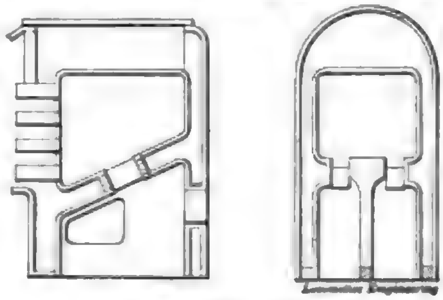
Note—The rod connected to compounding cylinder is forward in simple and back in compound, both going ahead and backing up.

R. Atkinson,
Mechanical Supt.

Mechanical Dept., Montreal, Sept., 1897.

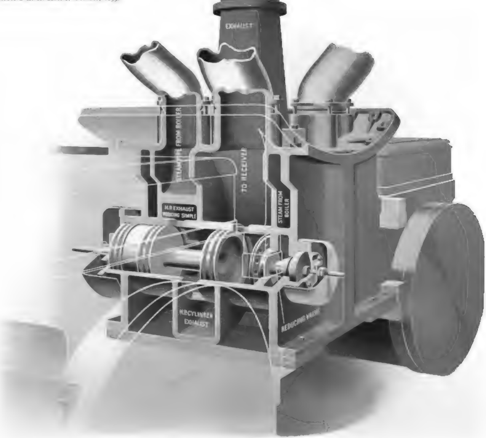
A New England Reminiscence.

On a recent trip to Providence we had the pleasure of a visit with Mr. L. J. Patton, now in the oil room of the New York, New Haven & Hartford road at that point. In common with many railroad men around Providence, we remember Mr. Patton as long as we remember anybody, and were pleased to find him looking hale and hearty still.

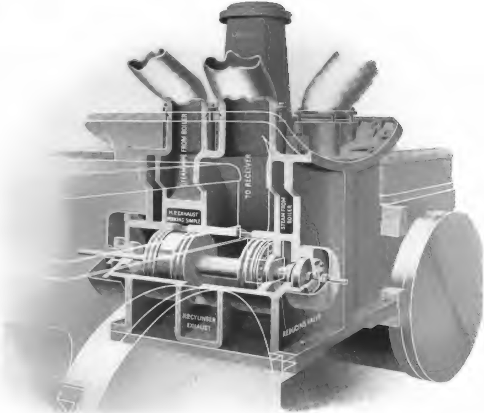


O. W. BAYLEY'S FIREBOX.

The engraving shows the old "New York," an inside-connected Griggs engine, which Mr. Patton took to run in 1854, and a splendid engine it was, too. This was the engine that laid out the old Bayley double-barrel firebox, 'way back in the days when Alexander Holley was engaged in railway tests.



PITTSBURGH COMPOUND LOCOMOTIVE—INTERCEPTING VALVE IN SIMPLE POSITION



PITTSBURGH COMPOUND LOCOMOTIVE—INTERCEPTING VALVE IN COMPOUND POSITION.

MOTIVE POWER BOSTON & PROVIDENCE RAILROAD COMPANY.

NOVEMBER, 1856.

Name of Engine.	Builder.	Reception.	Valve Gear.	Cylinder Connection.	Diameter of Cylinder.	Length of Stroke.	Length of Ports.	Width of do.	Width of Exhaust.	Diameter of Drivers.		Number of Drivers.	Number of Trucks.	Length of Grate.	Width of Grate.	Depth of Fire Box.	Diameter of Boiler.	Number of Tubes.	Length of Tubes.		Diameter of Tubes.	Diameter of Blast Pipe.	Diam. of Safety Valves.	Tender Capacity. Wood.	Tender Capacity. Water.	Weight of Engine, Running Order.	Weight on Drivers.	Weight of Tender, Filled.	Tube Surface.	Fire Box Surface.
					In.	In.	In.	In.	In.	Ft.	In.			In.	In.	In.	In.		Ft.	In.	In.	In.	In.	C'ds	Gall's	Lbs.	Lbs.	Lbs.	Sq. Ft.	Sq. Ft.
Boston	Edw. Bury		Link motion	Inside	12	18	7	1⅛	1¾	5	0	2	4	32	41½	42	36	76	7	8	2¼	1⅝	2½	¾	780				243.2	40.3
Norfolk	Geo. S. Griggs	May, '45	Drop Hooks and Lap Valves	"	14½	18	8½	1	2	4	7	4	4	31½	40	40	38	116	9	6	1¾	1¾	2½	1½	1358	34460	20555		504.8	44.8
Suffolk	"	May, '46	"	"	14½	18	8½	1	2	5	0	4	4	30½	40	46½	38	121	9	6	1¾	1¾	2½	1½	1335	35705	21705		526.6	50.5
Bristol	"	June, '46	"	"	14½	18	8½	1	2	5	0	4	4	31½	40	40	38	121	9	6	1¾	1⅝	2½	1½	1354	35805	21050		526.6	44.8
Massachusetts	"	Dec., '46	Link motion	"	14¾	18	8½	1	2	5	0	4	4	33½	37½	48	41	131	9	9	1¾	1⅝	2½	1½	1253				585.2	52.0
Blackstone	"	April, '47	"	"	14¾	20	8½	1	2	5	0	4	4	33¾	40	43	41	135	9	9	1¾	1⅝	2½	1½	1269				603.0	49.2
Taghconic	"	Jan., '48	"	"	14¾	18	9	1	2	5	6	4	4	34½	40	49½	40½	135	10	0	1¾	2¼	2½	1½	1526	41500	26480		618.5	56.5
Narragansett	"	Feb., '48	Fixed, Cut Off	"	16	20	9	1	2	4	6	4	4	33	40	40	40	135	10	0	1¾	1⅝	2½	1½	1526	40100	24000	28800	618.5	49.5
Iron Horse	"	Sept., '48	Link motion	"	14¾	18	9	1	2	5	0	4	4	33½	39½	44	42½	134	11	0	1¾	2¼	2½	1½	1281				675.4	50.8
Rhode Island	"	Sept., '48	Fixed, Cut Off	"	14¾	20	9	1	2	5	6	4	4	33½	39½	45	42½	134	11	0	1¾	2⅛	2½	1½	1280	44507	28307		675.4	50.8
Providence	Taunton Co.	Feb., '49	"	"	15	18	9	1	2	5	0	4	4	37	39	46	41	129	10	0	1¾	2⅛		1½	1531	44400	28000	18400	591.0	54.4
Canton	Geo. S. Griggs	May, '49	Link motion	"	14¾	20	9	1	2	5	0	4	4	35	39	50	42	135	11	0	1¾	2⅛	2½	1¾	1471				680.4	56.6
Neponset	"	June, '49	"	"	14¾	20	9	1	2	5	6	4	4	35	39	50	42	123	11	0	2	2⅜	2½	1¾	1471	43050	28000		708.4	56.6
Highlander	"	June, '50	Dp. Hooks, Lp. Valves	"	14¾	18	9	1	2	4	0	6	0	33	39	47	45	142	9	4	1¾	2	2½	1⅞	1430	41200	41200		607.2	51.8
Roxbury	"	April, '51	V. Hooks, Lp Valves	"	9	16	7	⅞	1¾	4	6	2	4	20½	32	38	31	113	8	0	1½	1½		⅞	300	25350	7150		357.7	29.3
Dedham*	"	May, '51	"	"	9	16	7	⅞	1¾	4	6	2	4	20½	32	38	31	113	8	0	1½	1⅝		⅞	300				357.7	29.3
W. R. Lee	"	Sept., '53	Variable Cut Off	"	15½	18	12	1	2	5	6	4	4	41½	37	60		126	12	0	2	2⅜	2½	1¾	1473	48950			904.8	71.9
Washington	"	Sept., '54	Link motion	"	15	20	12	1	2	5	6	4	4	41½	38	60		107	10	0	2¼	2½	2½	1¾	1475	48000	30666	29943	756.3	70.6
New York	"	Dec., '54	"	"	15	20	12	1	2	5	0	4	4	41½	38	60			12	0	2¼	2⅝	2½	1¾	1470	48050	29950	29950		
Mansfield	Taunton Co.	Aug., '55	Variable Cut Off	"	16	20	12	1	2	5	0	4	4	50	38	60		134	12	0	2	2⅜				52000	34300	37000	947.2	76.3
G. S. Griggs	Amoskeag Co.	Aug., '55	Link motion	Outside	15	22	14	1⅛	2	4	6	4	4	41½		50						2⅝				52500	30000	34870		
Attleborough	Geo. S. Griggs	Oct., '55	"	Inside	15	20	12	1	2	4	6	4	4	37	42	54	45	135	9	0	1¾	2⅜	2½	1½	1387	44300	20880	20800	556.6	66.0

*Sold.

GEORGE S. GRIGGS, *Supt. Motive Power, Boston & Providence R. R. Co.'s Machine Shop, Roxbury, Mass.*

It had a water-leg portion in the center, a door for each half, and also a water table over each side. This made two holes in the water table and one in the partition. The holes in the water table were fitted with dampers. When firing one side the damper over that side was closed and the liberated gases forced to pass through the partition and over the other fire. The sketch, taken from Holley's book gives the idea. It was a great scheme, but it didn't work.

The Old Colony, Providence & Worcester and Boston & Providence roads each chipped in $1,000 to have the engine tried, and selected A. L. Holley to make the tests. Such confidence was placed in him that no one else was engaged; and though he had believed the plan a good one, he acknowledged defeat when it ran against the old "New York."

This engine also made the run from Boston to Providence, forty-four miles, and made twelve stops, in 1 hour and 20 minutes—not bad time, and almost as fast as they do it now. It was, however, used mostly in pulling the York freight, which Mr. Patton ran for forty years.

The table of motive power in 1856 is also interesting and contains lots of information. Note the small grate surfaces and heating surfaces—remembering, of course, that in 1856 they were all wood-burners.

The "lap valves" may puzzle some of the younger men, and we quote from an old-timer in regard to them: "They called the engines having no independent cut-off 'lap valve' engines. They used all the valve they could and start the train. Some of them had 1 inch lap, I think, and only 3½ inches travel. This caused them to cut off at about two-thirds stroke, which helped them after they were under way, but made them poor starters. Their strong point was 'simplicity,' as they were worked by a plain eccentric."

A Fire Lighter.

At the Illinois Central Railroad roundhouse in Freeport, Ill., they light up fires in the locomotives with an oil burner, which is used below the grates. A piece of ⅜-inch gas pipe, long enough to reach any part of the grates from the back damper opening, is connected to the junction of the air and oil pipes. The atomized oil flows through this pipe, and is blown out of two holes in the cap over the end of the pipe, 3-32 inch opening.

Coal is put on the grates as usual when lighting up with any oil kindler; a piece of oily waste wound around the end of pipe and set on fire. When the air and oil are turned on the blaze comes up through the grates and ignites the coal much quicker than when used on top of the coal. Of course there is a steam supply pipe attached to the engine blower, which is worked moderately at first. The grates do not suffer any from this method.

accurate finish of working parts, we should advise the Midland Railway people to take a set of side rods from an American engine, put one set above the other, and see how nicely mandrels will go down through the bearings. Do the same thing with an English-built engine, and let us know how the fitting compares.

Smoke Prevention of the Chesapeake & Ohio.

Having heard a report to the effect that the Chesapeake & Ohio Railway people were using a special form of firebox for the prevention of smoke, we wrote Mr. W. S. Morris, superintendent of motive power, for particulars, and received the following reply, which will interest many of our readers:

I have your inquiry of August 29th, relative to special kind of fireboxes for preventing smoke. Beg to advise that we still manipulate with the ordinary firebox, but use our New River smokeless coal for passenger engines. In addition to this we have taken the stand that in the manipulation of the scoop shovel and the education of the engine crew lies the best method for preventing smoke as far as possible. I am very much gratified to be able to say that while this system of education on this subject has been going on but a very short time, we are already experiencing very much improved results. Our men seem to be very much interested, and are doing all they can in this direction. Every day brings forth increased improvement in the way of eliminating smoke from our trains. It is needless to say that I have gotten a number of your small books on the subject of smokeless firing, and instead of sending them out promiscuously, it is my purpose, when giving a brief lecture to enginemen, to take one out of my pocket to prove what I have said about what is being done on other roads. This, I think, is having a better effect than sending them out broadcast, because I know the men I am giving them to.

I believe this smoke question is one of the most important that can be agitated among the engine crews of any railroad at the present time. With all of the experiences I have had with patent devices for smoke prevention the most successful one I have had lies in the engine fireman and the wooden end of the scoop shovel.

United States Railways Models for Russia.

The number of Russian railway officials sent by that government to study railroad machinery and railroad operating in the United States has for years indicated that our methods and machinery were in high favor in Russia. This is now bearing rather palatable fruit. A particularly well-informed correspondent in St. Petersburg, writing lately to the *London Times* on this subject, says:

"The railways which are being built in almost every corner of this vast empire will, no doubt, contribute powerfully to the rapid commercial development of the country, all the more because, in many of the provinces, roads and means of communication are of a very primitive nature. The enormous distances which separate the various commercial centers make rapid transit very desirable, if not imperative, and the authorities have for a number of years given much attention to improvements in the freight service. Commissions have been sent out to various countries to study the methods of more experienced nations. The methods followed in the United States were followed with special attention, more particularly in regard to the use of continuous air brakes on goods trains. To the outsider it has always appeared illogical that in Europe passenger trains should be invariably so equipped, while freight trains, with their enormous weight and momentum, are unprovided with proper brake appliances to stop them quickly in case of need. The introduction of continuous brakes on passenger trains has, no doubt, been beneficial and reduced the number of accidents, but anyone who studies the question will notice that almost every week there are serious accidents due to freight trains being unable to stop in time, or to parts breaking away on inclines. The Russian Government, which has, for a number of years, used air brakes on its passenger trains, has decided to provide its freight and military trains with the same appliance, thus enabling them to increase in speed and safety simultaneously.

"A few months ago mention was made in these columns that a beginning had been made in that direction by giving the Westinghouse Brake Company a contract for several million roubles for freight brakes, but the matter has now been carried an important step further. The official journal of the Ministry of Ways and Communications now contains a ministerial order to all Russian railway companies (private railways as well as the State railways) to equip their freight rolling stock which runs in direct traffic with the Westinghouse quick-acting brake in four years from January, 1899. Russia will thus be the first country in Europe which will use continuous air brakes for its freight and military trains. The Russian Westinghouse Company, which works under the general management of Mr. A. Kapteyn, of London, has erected a fine factory in St. Petersburg, equipped with all the best tools and appliances. A large foundry is now being added to this factory in order to insure the quality of the castings and malleable iron fittings.

"The Westinghouse brake, which has been adopted in so many countries and which is well nigh universal on the European, American and Australian continents, seems to be, so far, the only system which is practicable on long freight trains. And, although the expense of installing it is considerable, still, important advantages are secured by its use, in the way of increased speed and security, while it realizes a notable economy in the cost of maintenance of rolling stock, and last, but not least, in the reduction of the number of brakemen on the train. Commercially, therefore, as American experience has long since shown, the expense of equipping freight trains with air brakes should not stand in the way of this valuable improvement in railway practice. Most elaborate technical instructions have been published in the official messenger of the Ministry of Ways and Communications, according to which it is calculated that 12,000 engines and 300,000 freight cars are to be fitted with the new brake; 20 per cent. of the latter are to be equipped with complete Westinghouse apparatus, and the rest with connecting pipes."

The minister who is chiefly answerable for this wholesale adoption of modern equipment is Prince Khilkof, the Minister of Ways and Communications.

How to Tell if a Crown Sheet Has Been Hot.

When a boiler explosion happens there is invariably the pretense that low water was the cause, and as the men who could testify to the contrary are generally dead, there is no evidence produced to prove the truth or falseness of the allegations. A paper contributed to the American Society of Mechanical Engineers, by Gus C. Henning, gives particulars of how to find out if sheets have been weakened by low water which deserves to be closely studied by every man responsible for the safety of boilers. The paper says:

"Low water, however caused, always produces excessive heating; and if the temperature rises sufficiently to weaken the material, failure may occur by stripping of the staybolts or rupture of the sheets by bulging between them, or otherwise. If the temperature has raised the material to a low or bright red color, this can be readily determined by superficial inspection. While the fire side will show red rust or a black color, the water or steam side will invariably show a typical steel-blue scale, which will not disappear even after years, as it is a so-called rustless coating. If this be once oiled it will always be distinguishable, even if the plates had been exposed to moisture and gases for years. The color of this scale will depend somewhat upon the temperature at which it was produced, being brightest at those points where temperature was the highest. Carefully made tests, with autographic diagrams, of such material will again demonstrate changes of properties, which are very characteristic. The yield point will be found very low, while the diagram will show a material drop of curve just after the yield point.

The elongation will, however, as a rule, be materially increased, with a diminution of tenacity. Nicked and quenched bending tests will again show marked differences between strips cut from the sheet at points which in one case were overheated or were above the low-water line, and in the other were taken from a part below this line. The fracture will also be materially different. To demonstrate the temperature at which the plates happened to be at the instant of explosion, it is necessary to cut strips from points of the overheated plate below the water line. These strips polished on the edges are then held in a clear fire so that one end remains cold while the other is heated to a dull yellow or a very bright red. This temperature being reached the bars are withdrawn, and while one is rapidly plunged with one end into a pot of boiling water, the other is allowed to cool in air, but not in contact with wet material or metal or stone. When the piece which had been immersed in boiling water about 1 inch deep has become nearly cold, below blue heat, it is plunged into cold water.

"On the polished edges of both bars will be found scale and heat colors, the temperatures producing them being well established. These bars are then carefully nicked at points opposite every change of color and then broken off at these nicks. By comparing these fractures and their scale and colors with those obtained from pieces cut from the overheated plates, the temperature at which they were at the instant of explosion can be determined with great accuracy. Having thus determined the temperature at which the sheets were during operation, it is also known whether the metal was sufficiently soft to bulge off or strip from the staybolts; examination of plates and bolts will verify the conclusion."

Good Advice about Building a Small Locomotive.

The Schenectady Locomotive Works have favored us with a little of their recent correspondence, which is interesting in several ways. It gives good advice to those who may think of attempting to build such machines without proper tools, and also shows how even a busy firm like the above give careful consideration to all their correspondents.

"Sanderson, Tex., August 15, 1899.

"Dear Sirs—Will you please give me a model of your engines and tell me how I can make a small one to run on the ground. I want to make one with as few works as possible. I am a boy thirteen years old, and please explain it all. I will make three or four cars and caboose. I want to make so it the engine will hold about 5 or 20 gallons and go ten miles an hour, and will pull 500 or 800 pounds. I want to make it myself. All I want you to do is tell me how. I want to play with it, because I have a telegraph line. I enclose 10 cents. Yours respectfully,

"Kyle Stansell."

The answer follows:

"August 23, 1899.

"Mr. Kyle Stansell, Sanderson, Texas:

"Dear Sir—We have your favor of August 15th, in which we are much interested. We believe that you have taken too much of a job, however, in building a small locomotive, and think that you better try something easier first. It would cost us probably several hundred dollars and a great deal of time of skilled workmen to build such a locomotive as you mention, and if you attempt it, it is almost certain that you will make a failure, and failures of this kind, you know, are very costly and discouraging.

"We think that you may be interested in a little pamphlet catalog which we have issued, and we therefore send you copy.

"We return the 10 cents, as we are very glad to furnish this information free of charge. Yours very truly,

"The Schenectady Locomotive Works."

BOOK NOTICES.

"The Slide Valve, Simply Explained." By W. J. Tennant, revised by J. H. Kinealy. Published by Spon & Chamberlain, New York. $1.00.

Although this is a little book of only eighty-three pages, it seems to cover the field in plain language, and the illustrations, though not as artistic as they might be, make matters clear to the reader. Different types of valves are shown, and there are numerous diagrams which will assist in understanding the problems. The link motion is briefly mentioned, but stationary engines are mainly referred to.

"Heat and Heat Engines." By Prof. F. R. Hutton. Published by John Wiley & Sons, New York. Price $5.

Although this is intended by the author to supplement his former book on mechanical engineering, it is, nevertheless, complete in itself, and forms a valuable addition to the literature of the subject. It discusses the energy of fuels, its liberation as heat and use for power purposes, as well as its laws and properties. The air compressor, the air engine and the refrigerating machine are treated at length, while the gas and oil engines receive their share of attention. It is written in the usual style of the author, and those who are familiar with Prof. Hutton's work will want to add this to their library.

As an example of even running, or uniform speed on long runs, we commend the New York division of the Pennsylvania as an excellent sample. The engineers know that they burn less coal in this way than by sudden spurts and waiting for time at stations, and they are after their coal premium. This is one of the advantages of the system.

Effects on Steel of Soap in Water.

The question asked by the T. S. Co., Chicago, is: Why is it not possible to temper steel in soapy water?

Without going into the chemistry of the subject, the simple answer is: Soapy water is a non-hardener because it does not rapidly abstract or conduct heat from the object to be hardened; and secondly, it produces a heavy scale which sticks tightly to the surface, the scale being oxide of iron, and this formation is the main preventive.

An interesting experiment to determine the action of soapy water is to prepare two samples of steel of the same area, say 1 inch round, and turn them to 7/8 inch round, also provide two buckets of water, one fresh and the other soapy, say about 5 per cent. soap.

Then heat both samples up to the same degree of heat as nearly as possible, and plunge one into the fresh water and the other into the soapy water at the same time.

As soon as the red disappears from the one in the fresh water, withdraw both from their respective baths and note the appearance of the two pieces. The one that has been in the soapy bath will brighten up and show a reddish heat, while the sample that was chilled in the fresh water will come out black, showing, as far as the experiment goes, that one bath will absorb the heat from the steel much faster than the other, and that consequently one piece becomes hard while the other is left soft.

To carry the experiment farther, reheat the two samples up to the proper hardening heat and then quench them the same as before, now only allow both pieces to remain in their respective baths until cold. Examine the surface of each piece when withdrawn and quite a contrast will be observed. The fresh water hardening will show very little, if any, scale, and what there is will be quite thin and loose. The sample from the soapy water will show a heavier scale, and usually it will stick tight to the steel—an oxide of iron has formed on its surface.

In some cases this will burst while in the bath, and settle to the bottom and can be collected, showing quite a scale. This formation on the article to be hardened is the real trouble, and prevents it from becoming hard.—R. A. McDonald, in *Sparks from Crescent Anvil.*

Siberian Railway.

The increase in traffic on the Siberian Railway is interesting as showing the need of such a road. In the three years of 1896, '97 and '98 there were 1,638,000 passengers carried, about 400,000 of these being emigrants. The freight traffic was 1,426,127 tons, exclusive of the goods of the emigrants mentioned. Of this enormous traffic, about half of it was carried in the last year.

A Heavy Locomotive for Mexico.

This engine is one of a lot for the Mexican Central, and has all the appearances of a very heavy locomotive, which in fact it is. They were recently turned out by the Baldwin Locomotive Works, according to designs furnished by the road.

The cylinders are 21 by 26 inches, driving wheels 55 inches, boiler 74 inches, and working pressure 180 pounds. There are 374 2-inch flues, which are a trifle over 11 feet long.

The total weight is 182,830 pounds, of which 160,630 pounds are on the drivers. The driving wheel journals are 9 by 12 inches, truck journals 5 by 11 inches. The driving wheel base is very short for a consolidation, being but 15 feet. The tractive power is about 32,000 pounds.

Roundhouse Floors.

At the Somerset roundhouse of the Queen & Crescent route and the new car shop of the Cincinnati, Hamilton & Dayton Railroad at Lima, O., the floor is paved with culled paving bricks, and makes a very good job. They never rot, rarely ever break, even when heavy tools like jacks are dropped on them, and if the foundation is well settled before they are laid they will stay as level as when first put down.

Engine-house floors of wood blocks set up endways are not unusual. When oil enough was spilled on them to preserve the wood from dry rot, they did very well for a long time, but nowadays they do not seem to last as long.

Very fine crushed stone on top of a layer of coarse stone makes a very good floor. It soon gets hard and smooth, with no dust. Of course, a floor of any kind in a roundhouse is like a good street pavement. The foundation which holds the floor up must be solid and enduring. Some provision must be made for a place to set jacks when necessary to lift engines and tenders.

Concrete makes a very firm foundation for any shop floor. When you have gone far enough in the work of making a good floor to lay a concrete foundation, just go a little farther and put a concrete top surface on it.

A great many concrete pits for roundhouses are being put in; anchor bolts in the sides for the heating pipes, as well as on top for the oak planks the rails are laid on, are put in when the side walls are laid up. These pits are easily kept clean, and if properly made should last as long as a stone pit. Oil or hot water may affect them, but they have not been in service long enough to determine this point.

The Ajax Metal Company, of Philadelphia, desire to extend a cordial invitation to all railroad managers, motive-power and mechanical officers, to pay them a visit at Section M-13, Main Building, of the National Export Exposition, which is now being held in that city. They have a representative there at all times, and take pleasure in offering their services to all visitors, whenever or wherever they can be useful. They will provide ample facilities for correspondence, and will gladly give every attention, if the opportunity is afforded.

A HEAVY CONSOLIDATION FOR MEXICO.

Stephenson as a Prophet.

In "Greville's Memoirs," published in 1834 by Charles C. F. Greville, we find the following, under date of January 28th of that year. It would be interesting to know how he ascertained that 400 miles an hour was the limit:

"Stephenson, the great engineer, told Lichfield that he had traveled on the Manchester & Liverpool Railroad for many miles at the rate of a mile a minute; that his doubt was not how fast his engines could be made to go, but at what pace it would be proper to stop; that he could make them travel with greater speed than any bird can cleave the air, and that he had ascertained that 400 miles an hour was the extreme velocity which the human frame could endure, at which it could move and exist."

A Mixed Idiom.

L. W. Hill is a son of J. J. Hill, president of the Great Northern. The young Hill got a first-class business training on his father's railroad, beginning as a clerk of low degree and rising upwards till now he is assistant to the president, and ready to take hold as general manager.

Young Mr. Hill is about as bright a youth as anything turned out in the Northwest, and holds his own among railroad officials and financiers when he visits New York. One day he and his father were dining with Mr. Schiff, the well-known New York banker, and the banker and young railroader had considerable talk together about railroad matters. Mr. Schiff seemed wonderfully struck with the young man's acuteness. The banker is not perfect on English idioms, but he wanted to pay a compliment, and, turning to Mr. Hill, remarked: "That son of yours is a chip of the old blockhead."

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Air-Brakes for the Government Railways of Russia.

The Westinghouse Brake Company, Limited, of London, England, began, more than a year ago, negotiations with the Russian Government for air brakes for the state railways. A new company was formed, and a manufacturing site in St. Petersburg was purchased and work on a plant begun. At a congress of railway engineers, in January last, it was decided to adopt the Westinghouse system. On June 5th there was issued an imperial decree, announcing that all locomotives and tenders and a sufficient number of freight cars to control all freight trains in the Russian empire be equipped with air brakes by January 1, 1903.

The decree further requires that the Westinghouse air brake shall be purchased exclusively and that all other makes of brakes shall be excluded from train service. There is a provision, however, that a trial of any other kind of brake may be made along with the Westinghouse in local trains, and that such trials shall be under the direction of the Imperial Brake Commission for three years. At the end of this trial term, the suitability of the brake shall be passed upon by a commission of rolling-stock representatives, and afterwards ratified by the Imperial Commission.

This decree gives to the Westinghouse company the extraordinary concession of the sole right to manufacture air brakes for actual service for all the railroads within the Russian empire for three years to come; leaving, however, the field open for all competing brake systems to establish their equality. This decree also gives, by actual computation, orders for Westinghouse brakes for 350 locomotives and tenders and 1,750 freight cars per month for the next three years; this large number of brakes being valued at about $15,000,000.

The Russian Government requires that all air brakes, whether for experimental or actual train service, be manufactured in Russia. The new Westinghouse works at St Petersburg, which have been in operation about two months, are now being doubled in capacity.

Our attention was recently called to a case where a large gash had been cut by a cold chisel through the air-strainer screen of the 9½-inch pump. The strainer had become coated with dust and grease, thus restricting the air inlet; and this heroic measure was taken to free the inlet, rather than clean off the strainer.

Tests of Street Car Brakes in New York City.

Judging from the numerous and serious accidents which have recently resulted from electric trolley cars getting past the motorman's control and running away on down grades, the brake trials for street-car brakes now being held on the Metropolitan tracks at One Hundred and Fifty-fifth street by the State Railway Commissioners are timely and highly important.

During the past summer several cars got beyond control, and, loaded to their extreme capacity with human freight, either left the track at high speed or collided with other cars, seriously injuring or killing a number of the passengers.

That gross and even criminal negligence is practiced by many electric trolley car companies is manifest when an inspection is made of the flimsy and abortive monstrosities, called brakes, placed on street cars. Now that street-car speeds have become high, and passengers are crowded into the car far beyond the limit permitted on steam cars, there is every reason why a brake, equally if not more efficient, be fitted to every car, and particularly to cars in inter-urban service. In fact, a high-speed street car should have at least as efficient brake as a steam railroad car; and the Railroad Commissioners are right in holding that one of the most pressing needs of the trolley roads is an efficient brake which can be depended upon to be equal to all emergencies.

Air-Brake Instruction Cars at the Traveling Engineers' Convention.

The interest taken by the railway people in the Traveling Engineers' recent convention in Cincinnati was manifested by the presence of air-brake instruction cars from four large systems. The cars and gentlemen in charge were as follows: Chesapeake & Ohio, C. P. Huntley; Big Four, W. J. Hartman; Michigan Central, W. W. White; and Cincinnati, New Orleans & Texas, M. M. Greenwade. It was our intention to illustrate these cars, but the photographs taken of them would not admit of reproduction.

An Error Corrected.

Last month in our treatise of the "Leverage of the Locomotive Driving Wheel," an error crept in in the last paragraph of the article, on page 409. The correction should read, "in relation with the engine frame," instead of "in relation with the ground."

More Brake Power Needed.

On every hand, writes C. B. Conger, we see new passenger engines coming into service larger than the old ones, calculated to draw heavier trains at a higher speed than ever before; but we do not see that anything but the ordinary quick-action brake is used to stop these fast trains on a fair share of the roads.

Scores of regular trains are running every day in the West at speeds which call for actual running time between stops of sixty miles an hour and over. The managing officers call on the entire force to see that these high speeds are made regularly. In case the train is delayed, as much lost time as possible should be made up.

While the matter of attaining this high speed is being carefully looked after in powerful engines, good track and prompt despatching, the question of stopping quickly in case it is necessary is not at all helped out by heavy engines; it is a matter of braking power. Leaving to one side the dangerous practice of running on heavy fast trains twelve-wheel coaches with brakes on only eight wheels, it is a well-understood fact that trains braked on every wheel up to the standard limit for moderate speeds need a higher braking power for the higher speeds in order to make quick stops, liable to be required on any trip, to avoid dangers which may come into view. These dangers are not known to the engineer till he can see them, and he must then bring the train to a stop before reaching that point, or it may result in a serious accident. Take, for instance, a derailer at a crossing protected by a semaphore. It cannot be seen far enough off to make the stop after seeing the signal, and to make the time a high speed is required. The fact that so many precautions are taken to give these fast trains a clear track is an argument used; but we think it would be quite in the line of safe practice to also give these fast trains everything in the line of increased braking power that has been devised and perfected up to this date. We say "perfected" advisedly, for there are devices on the market which have been in daily operation for several years that add to the braking power at high speed and do not interfere with the proper amount for slow speeds.

New equipment can have these devices applied at such a small advance in the price of the regular brake equipment, that the expense will be nominal.

We believe it will be in the interest of safety, comfort and economy to have them specified, and thus in a measure keep up

with the requirements of our modern fast train service.

Starting and running a train is not always a matter of safety; stopping it is. It is also a matter of prompt despatch and uniform speed when running, as good brakes influence this last item to a great extent. High-speed brakes are now a necessity of modern fast trains.

An Air-Brake Fad Analyzed.

Fads have their existence in air-brake matters as well as in manners, methods of dress, etc. For is not that thread-bare-worn fad of setting the hand brakes nearest the caboose to assist in holding a partially equipped air-brake train, resurrected by some subordinate official with annoying frequency and regularity? And have not the supporters of this fad spent more time and effort to fasten the causes of consequent break-in-twos elsewhere than would insure the success of a legitimate practice? And also, on roads putting on their first quick-action brakes, and having trouble with the rough handling of their freight trains, have we not had that old, decrepit order issued from lower headquarters, that all air brakes shall be coupled up and tested, but used in emergency cases only, the ordinary service stops being made with the hand brakes? This latter fad, however, we embrace as one containing hidden good. For the men forbidden to use the air brakes, will stealthily use them just the same, but with exceeding care; for each man knows if he is caught disobeying a rule, he will be punished. Thus careful handling is secured, and the order passes from memory.

The latest air-brake fad, or rather, the fad whose appearance above the present air-brake horizon is most recent, is that of cutting out the air brakes on the leading engine of a double-header train, so that in the event of a break-in-two between the two engines, the first engine can pull out of the way, and thereby avoid the damage consequent upon the two coming together.

This subject was interestingly discussed by two members at the recent convention of Traveling Engineers, somewhat as follows:

Mr. A.—But you lose the holding power of your brakes on the head engine, throw more work on your second engine and train, and reduce your ability to stop, which may prove fatal.

Mr. B.—I know, but you can't pull off a draw-bar, bumper beam or pilot, and smash up front ends and tenders each trip. These things cost money.

Mr. A.—But why don't you strengthen these parts? You are using to-day a pencil for a draw-bar which never was intended to stand the strain of double-heading.

Mr. B.—We can't, because freight is so heavy we can't spare the engine.

Mr. A.—Do it, then, some time when freight is light.

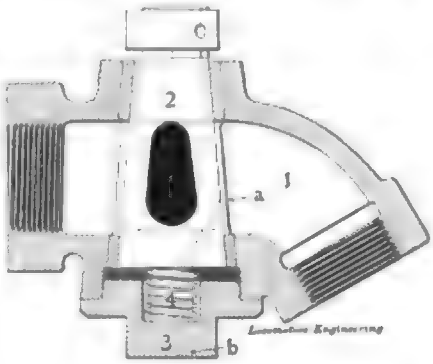
Mr. B.—We have other matters to look after then and don't think of it.

Mr. A.—Oh! I see—case of the Arkansas traveler—couldn't fix his roof while it rained; didn't need it fixed in good weather.

This little dialogue contains truth that should relegate the fad. Fix the couplings.

A Safety Angle Cock.

Some years ago, writes C. B. Conger, the angle cock had a small hole drilled through the side, and also into the cavity inside the plug, so that when the angle cock was shut, the air in the hose would bleed out through this hole and allow the hose to be easily uncoupled. In addition to this feature, it also acted as a safety feature; for this opening would let the air out of the hose fast enough to set the brakes on the train in case an angle cock towards the engine was closed. If the other one, next the rear end of train, was closed, the leak would be enough to call the engineer's attention. But these cocks



A SAFETY ANGLE COCK.

with the bleed holes drilled in them soon began to leak so badly that the practice of drilling them was abandoned.

About two years ago, on the Illinois Central Railroad, they made a trial of drilling a ⅛-inch hole obliquely down through the plug 2 to let the air from the hose down into the angle-cock cap or spring box 3, when the cock was closed, another hole being drilled through the cap 3, as shown in the annexed cut, to let the air outdoors.

This plan has proved a success with a two years' trial; none of them leaking through this opening when the cock is open, as was the case when the bleed hole was in the side of both plug and body of cock. They are used on engines and tenders only, and are not used on freight cars. They are not patented, and can be used by anyone who wishes to do so.

The annexed cut shows the hole in the plug at *a*, and in the cap at *b*, connecting the hose with the atmosphere when the cock is closed.

CORRESPONDENCE.

A Brief History and Description of "Mountain Brakes."

Editor:

A great many railroad men, air-brake men and others do not appear to have a very good idea of the "Le Chatelier," or water brake, and also the "Sweeney" air compressor, on account of most of them working on roads that do not have very heavy grades, and, consequently, do not need these appliances. For the benefit of those persons I give the following brief history and description of these brakes, which I hope will find room in your columns.

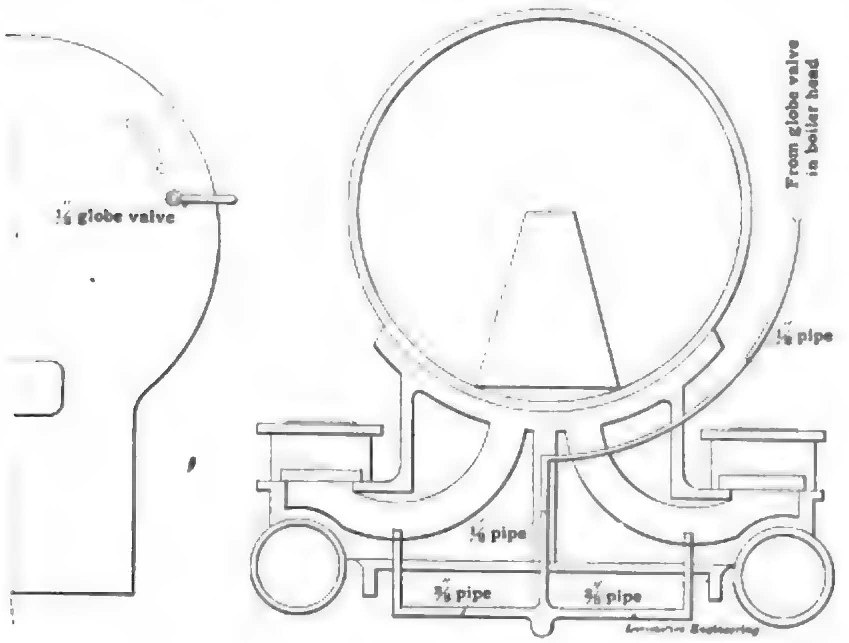
The "Le Chatelier," or water brake, is an old French patent, probably thirty or forty years old. When it was adopted in France, the understanding was that whatever number of cars an engine could haul up a grade, the same number could be held down the grade by the use of the water brake. This may have been true on a light grade and with the little, light, 10-ton wagons that are used in England and on the continent, but it cannot be done in this country, where we haul freight sheds on wheels, loaded to the roof.

The Denver & Rio Grande Railroad in Colorado was about the first road in the United States to adopt the water brake. When this road (narrow gage) was built over the Marshall, La Veta, Fremont and the Tennessee Passes in the Rocky Mountains, it had to make the grade 4 per cent. The Marshall Pass is twenty-six miles long, 4 per cent. grade. In bringing the little narrow-gage consolidation engines back down the hill after helping to push a train to the summit, it was found that the wheels under the tender got very hot and were liable to break; so the water brake was put on as an adjunct to help hold the engine. The air brake on the tender was used to make the stops and also to regulate the speed. I might add that with those engines that were in pusher service all of the time, it was very seldom that their cylinders had to be rebored, the action of the steam and water making the walls of the cylinders like glass, and there was very little wear to them.

The Atchison, Topeka & Santa Fé adopted the water brake after the road was built over Raton and the Glorietta Mountains. The Colorado Midland, knowing that they would have 4 per cent. grades, had it applied to their engines when they were built.

When the writer of this came out to the Southern Pacific, in 1883, to equip their freight cars and engines with the automatic brake, he found that on one grade, Tehacahapi, no pusher or light engine was allowed to come down the grade without from two to four empty flat cars to hold or steady them. The grade is 116 feet drop to the mile, twenty-five miles on the north side and twenty on the south

side. The fireman with his assistant (a coal-pick handle about 3 feet long) would let the engine and cars down the hill, while the engineer went to sleep. This, of course, necessitated having a train of empties back up the hill about every two days. I tried to get the management to put on the water brake, but they would not do it.



"LE CHATELIER," OR WATER BRAKE—BACK VIEW OF CYLINDERS THROUGH THE CENTER OF EXHAUST PIPES.

After the air brake was applied, then came the fireman's turn. He would couple up the two or four cars, test the brakes, turn up the pressure retainers, get up on the engine and go to sleep. The engineer would let the cars and engine down the hill, and when they would get to the foot of the grade, some of the wheels were generally found to be "three cornered," instead of round. The wheels got flat because no one looked after the retaining valves to turn them down when necessary, leaving stations, etc.

This trouble soon got to the ears of the management and, with an experience which the writer had one night, brought them around to adopt the water brake on all of their mountain engines.

We left Mojave one night with a pusher engine that had just been equipped with the air brake, driver and tender brakes. We helped the passenger train to the summit, turned on the "Y," and then went into the side track to get a couple of empty flats. There happened to be a number of non-air cars, so we took the first two. After leaving the summit, the fireman was told to go back and set up the two hand brakes lightly, and we could then do the holding with the tender brake.

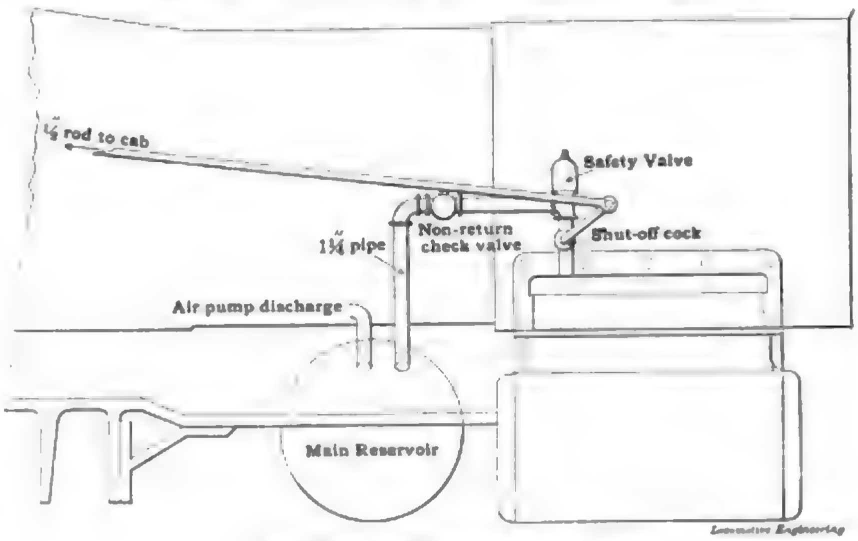
Upon reaching the Mojave yard, we stopped at the upper end, intending to drop the two cars in one of the side tracks, when the fireman informed us there were no ratchet dogs on the hand brakes. We had brought these two cars to help hold us, but were obliged to hold the whole business with the tender brake. When the general office was informed of this, together with the slid-flat wheels, the water brake was immediately placed on all of the mountain engines in a very short time. I should have added, perhaps, that when the fireman found that there were no dogs on the hand brakes, he failed to inform us, as he evidently did not want to go back to the summit and switch out any more cars.

On Soldier Summit grade on the Rio Grande Western in Utah, the water brake is used on all freight engines coming down with trains. The grade is seven miles long, and 4 per cent. The track is nearly all straight. In bringing sixteen cars of coal down this grade, cars loaded with 60,000 pounds of coal, the writer has noticed that the engine will hold itself and probably part of the head car, but no more. However, this is a very good thing, as the weight of the engine is taken off the train, and consequently the brakes do not have to be "cinched" up so tight, and the wheels do not then get so hot.

On the Siskiyou Mountains in Oregon, which the Portland line of the Southern Pacific crosses, the grade is 176 feet to the mile, and it is seventeen miles long on each side. The engines on both passenger and freight trains are compelled to use the water brake. When this part of the line was first operated, we had a great deal of trouble from hot wheels and their breaking. After they commenced to use the water brake there was no more trouble. As the passenger trains going down this grade generally have two engines on the head end, the retarding force exerted by the two engines is very great; and I have no doubt in this case they help to hold the train, as it takes very little air to do it.

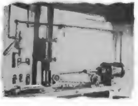
There is no doubt in my mind, that if all engineers running on heavy grades, or even on lighter grades, were compelled to use the water brake on their engines, that it would do away with a great many of the heated and broken wheels. The "Le Chatelier," or water brake, is intended to be used as an auxiliary to other brakes, and when used with discretion is a valuable aid in steadying a train down mountain grades. It is most effective on a steady speed of from three to twelve miles an hour, above which latter speed it is of lessened value. It should not be used at a greater speed than eighteen miles per hour, and is for mountain work only.

As will be seen by the accompanying sketches, water is led by a small pipe connected to the boiler below the water line of same to the exhaust-pipe cavity, and through to the cylinders. This affords a counter pressure on the pistons when the engine is reversed, which should be just back of the center notch of the quadrant.



THE "SWEENEY" AIR COMPRESSOR.

The act of forcing compressed, moist vapor (which the water jet, drawn into the cylinders with the engine reversed, supplies) causes the retarding force on pistons, operating through the connections on the crank pins, and gives the desired brake power. Only a very small amount of water is used, a portion of which passes through the open cylinder cocks. The amount of brake power exerted de-



A HOSE-STRIPPING MACHINE.

pends upon the position of the reverse lever.

To operate the water brake, first have the engine at slow speed, without steam; have cylinder cocks wide open, and keep them open, with reverse lever placed one notch back of the center, and throttle securely shut. Give the small water-cock one-eighth of a full turn open, and notice that steam and water pass through the cylinder cocks freely. The speed may now be regulated by placing the reverse lever back as required, and should be done without any change in the water-cock. A too free use of water is dangerous to cylinder heads, and water may be forced out of the stack and does not produce any useful effect.

In shutting off the water brake, throw the reverse lever ahead slowly, first closing the water cock, to avoid throwing water from the stack. It must be remembered that the water brake acts on the drivers only, and that the combined use of water and driving brakes will be too great, and cause the sliding of wheels; hence the combined use of water and driver brakes must not be made.

Light engines when fitted with air and water brakes, are best controlled by setting the water brake moderately and using the air brake to regulate speed. Here is also a very good rule that railroads might adopt when operating on heavy grades. When two or more engines are coupled to trains descending mountain grades, the engineers not operating the air brake must assist in retarding speed by using the water brake to some extent, with the view of preventing slid and heated wheels.

The Sweeney air compressor is another "mountain brake," and is a device attached to engines as an auxiliary brake to enable engineers to maintain air pressure in the brake system in case of failure of the air pump, or to obtain a quick recharging when descending mountain grades.

This device consists of a valve and spring to resist a pressure of 90 pounds, attached to the top or the side of the steam chest, as most convenient to suit the style of engine, a cut-out cock being placed between the safety valve and the steam chest. This valve is operated from the cab of the engine. A discharge pipe connects the steam chest and the main reservoir. In this discharge pipe is placed a check valve, preferably close to the main reservoir.

When it is necessary to use the device, steam being shut off, the reverse lever should be placed slightly back of the center notch, and the cylinder cocks left open for three or four revolutions of the engine to allow water that may be in the cylinders to escape. Then the cylinder cocks should be closed, the cut-out cock opened and the brake-valve handle placed in charging position. The reverse lever should be left back of the center notch at least fifteen seconds after full pressure has been indicated on the air gage. Then before the reverse lever is moved forward, the brake valve should be placed on lap. The cut-out cock can be left open if it is necessary to use the device a number of times; but it is best to close it after each application. This device should only be used in cases of emergency.

If it is applied to a two-cylinder compound engine, the device should be placed on the steam chest of the high-pressure cylinder. If the water brake is applied to a two-cylinder compound, it need only be attached to the exhaust cavity of the low-pressure cylinder.

The Southern Pacific has the Sweeney air compressor attached to all of their engines. An engineer running in the valley is supposed to get to his terminal point by the use of this device, if his air pump should give out on the road. I send you a couple of sketches of these devices.

H. C. FRAZER.

San Francisco, Cal.

An example of careless piping was observed on an engine recently coming from the shop, where eleven elbows, three unions and one tee in the pipe connection between the triple valve and driver brake cylinders were found.

Hose-Stripping Device.

Editor:

The accompanying cut represents a recently patented air-brake hose stripper, by the use of which one man can remove over 1,000 hose per day without injury to material, and with a coupler costing but 5 cents. A saving, in round numbers, can be made in every 1,000 hose removed of $500. BUKER & CARR.

Rochester, N. Y.

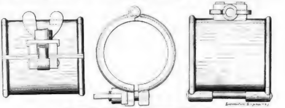
[For further information address Buker & Carr, Fairview Heights No. 19, Rochester, N. Y.—Ed.]

A Hose-Patching Device.

Editor:

I enclose herewith a drawing of a metal hose patch for which I have applied for a patent. This clamp, as you will see, will be made of malleable iron, 1/8 inch thick, with stiffening rib around the outer edges. It is all in one; that is, it hinges out to apply, and is fastened by the hinge bolt with a thumb screw. The washer, as shown, is tapered, as is the lug on side of body, making it sure of not coming off after it is applied. I have tested it on bursted air hose, and applied it in ten seconds; as you will see, reducing the delay to trains to a minimum. It is better and easier to apply with pump working, saves the shutting off of angle cocks, stopping of pump, loss of air and large saving of time and expense, as a patched hose can be safely run as long as desired, and can be patched its full length.

The patch is made to the circle of hose size, but left 1/4 inch open to insure a tight grip. This patch is designed to be applied also to fire hose in same manner, saving the shutting off of the engine at a fire to replace sections of bursted hose, often entailing great loss by fire gaining headway. It is also applicable to pipes of any kind, with rubber placed between the pipe and the patch.



A DEVICE FOR PATCHING A BURSTED AIR HOSE.

The patch is light and can be carried in pockets of brakemen in train service. It is simple and easy to apply, and instead of the whole train crew assisting to replace bursted hose, the brakeman finding the leak can put on patch, ready to go before conductor or engineer could get the tools ready, as they have to now.

I send you this, hoping you will con-

sider the features of it, and knowing your fairness and knowledge on all such matters.

J. J. FLYNN,
L. & N. Ry.

Louisville, Ky.

A Brake Pressure Regulating Device.

Editor:

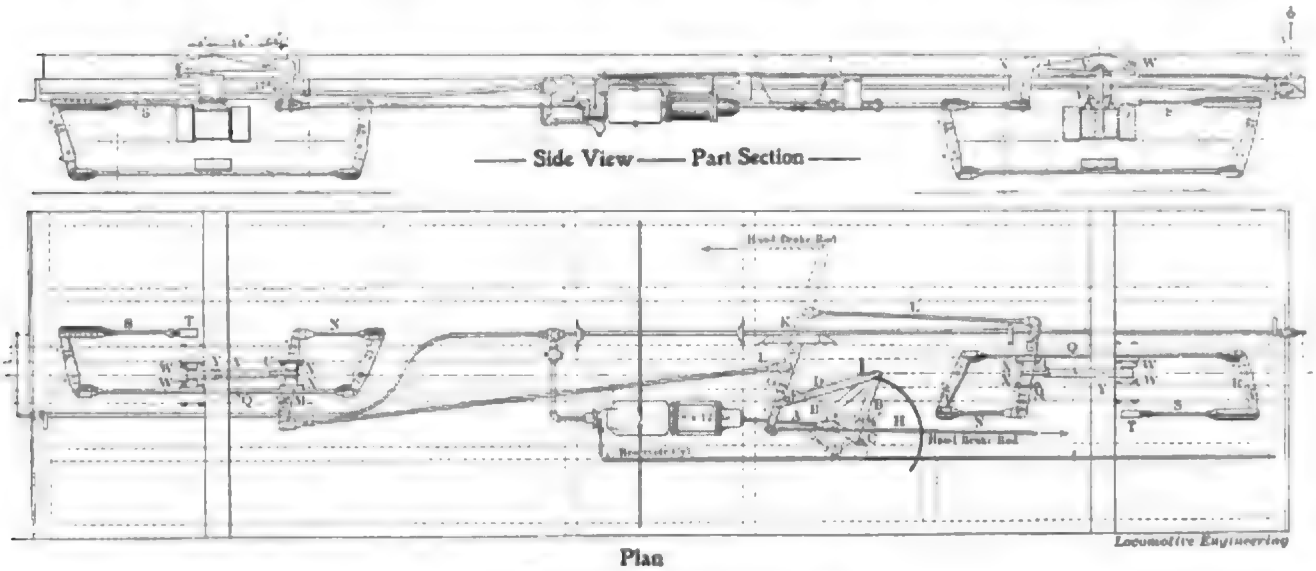
Our brake pressure regulating apparatus consists of two devices, cuts of which we send you herewith. With the first device the increase in braking pressure is accomplished without increase in the train line pressure or the initial piston travel. This increase in braking pressure is easily and simply made by merely increasing the leverage of the cylinder lever, but as such increase of leverage necessarily gives a proportionately greater stroke of the piston to take up the brake-shoe slack, there is introduced between the push rod and the cylinder lever a combination of lever and links. With this combination the first part of the stroke of the piston gives a very rapid motion to the cylinder lever, thus taking up the brake-shoe slack quickly; as further travel of the piston gives a much slower motion to the cylinder lever, the braking power is greatly increased over that of the initial travel.

The second device prevents the braking pressure on the shoes increasing sufficiently to skid the wheels. This is accomplished by making a relief to the brake-shoe pressure by slightly lifting the ends of the car and permitting the compressed air in reservoir and cylinder to expand, which is done by introducing between the truck and car body a weighing lever and bent lever, to which latter the brake levers are connected, and through the movement of which, by the weighing of the car and its load, the braking pressure is maintained at a certain predetermined maximum. It will thus be seen that as the car body is loaded a greater amount of power is required to lift said car body and load from the truck, and as such power is obtained through the medium of the brake levers, therefore this increased power will necessarily give an increased braking force on the wheels, through the medium of the brake levers. The levers are so arranged also that if the load is unequally distributed in the car, the braking pressure on each end of the car will be proportioned to the load on that end. By referring to the following engravings and descriptions, the simplicity and practicability of these devices will be seen.

By referring to the drawings it will be seen that the air-brake reservoir and cylinder remain in the same location as in the present equipment, and interposed between the push-rod *A* and the cylinder lever *G* is a triangular lever *B*, fulcrumed at *C* and connected at its outer or longer end by the links *D* and *F* to the cylinder lever *G*. The cylinder lever *G* is fulcrumed at *K1*, and cylinder lever rods *L*, *L1* are connected to it at equal distances on each side of said fulcrum, thus distributing the power to each end of the car. The connections between cylinder lever *G* and brake levers are shortened, and instead of carrying them from the cylinder lever to the further brake lever they are carried from the cylinder lever to an equalizing lever *M*, situated between the brake levers. From the opposite end of *M* a short link connects the inner or nearer brake lever; the connections from there are the same as commonly used. The fulcrum point of equalizing levers *M* is on the lower end of bent levers *U*, shown clearly in the side view. This lever *U* bears on the top of weighing lever *V*, whose fulcrum point is the top of the king bolt *Y*. The king bolt has a collar upon it which bears upon the lower center plate. The fulcrum point of the bent lever and the larger end of the weighing lever are supported on short gudgeons or pieces of 2-inch cold-rolled shafting, let into cast-iron boxes *X X* and *W W* fastened to the center sills of the car. It will thus be seen that the floating lever rod and the floating lever, with its brackets and hanger as used on present equipments, have been dispensed with and that the cylinder lever rods have been shortened, and the only additions made over the present equipment are the triangular lever, with its links, and the two equalizing levers and their weighing levers.

The piston is at the beginning of its stroke and the push-rod is connected to the triangular lever *B* in such a manner that, as it moves ahead by the action of the piston the outer end of the triangular lever, to which the lever *G* is connected, travels very much more rapidly than the end of the push-rod, but that as it moves forward its speed decreases and the leverage of the push-rod increases until finally the pin connection between the links *D* and *F* drops into the socket *B1* of the triangular lever, close by the push-rod, after which the relative speed of the push-rod and cylinder lever remains the same, the link *D* merely swinging around with the triangular lever *B*. In the movement from its initial position as shown, until the pin connection between link *D* and *F* reaches the socket, the slack in the brake shoes is taken up and the brake shoes firmly clamped to the wheels, after which the leverage remains the same and the braking pressure is at its maximum.

Referring to connections and devices on one truck, it will readily be seen that after the brake shoes become clamped to the wheels that the increase of pressure on the cylinder lever will produce increase of pressure on the brake shoes through the medium of the equalizing lever *M*, but as the equalizing lever *M* is held to its work through its fulcrum point on the lower end of bent lever *U*, that a forward movement of bent lever *U* will prevent any further increase of pressure on the brake-



Plan

A BRAKE PRESSURE REGULATING DEVICE.

beams, and the end of equalizing lever *M* connecting the link *N* becomes the fulcrum point. Now as a forward movement of the bent lever *U* will also produce a movement of the weighing lever *V* and weigh the end of the car, therefore the weight of that end of the car forms the limit of the braking pressure on the wheels of that truck, and by so proportioning the arms of the bent lever and the equalizing lever, the percentage of braking pressure on the shoes of this truck can be made any percentage of the weight of this end of the car.

It will be clearly seen that if a load is placed in the car over this truck that said weight tends to increase the braking pressure, since it requires a greater amount of power applied to the equalizing lever to lift said load and weight of said car through the bent lever *U*, but that, as before, when the braking pressure on the shoes becomes a certain percentage of the weight of this end of the car, through the lifting movement of the weighing lever *U*, further increase of braking pressure is prevented.

What is true of the action of devices on one truck is also true of their action on the other truck; therefore, since cylinder lever *G* is fulcrumed at *K1*, the devices on one truck are independent of those on the other, and the braking pressure on wheels of each truck is proportional to weight of car box and load carried by it.

O. W. DEAN.

Chicago, Ill.

[Persons desiring special or detailed information on this device should write for same to O. W. Dean.—Ed.]

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(66) J. B. M., Buffalo, N. Y., asks:

Will you please tell me just how much more efficient the 9½-inch pump is than the 8-inch? What I want is some relative comparison in air they will make. A.—The 8-inch pump in good condition will compress and deliver 20 cubic feet of atmospheric air at a pressure of 90 pounds, the pump making about 110 single strokes per minute. The 9½-inch pump will compress and deliver about 33 cubic feet of atmospheric air at a pressure of 90 pounds at about 100 single strokes per minute. A single stroke is reckoned either one up or one down.

(67) C. N. B., Moberly, Mo., writes:

When you have a double-head train—I mean with both engines on the head end—is it the right thing to do to cut out the driver brake and the brake on the tank of the head engine? This question was raised because when the first engine broke off, her brakes set and stopped her, and the second engine and train ran into her. Please settle this question for several readers. A.—No. Keep brakes on both engines cut in. If the coupling breaks or separates, locate the cause and fix it. See same subject treated at greater length elsewhere in this department.

(68) C. W. M., Hempstead, Tex., writes:

Please let me know in LOCOMOTIVE ENGINEERING what is the tension of graduating spring in the triple valve. A.—The tension will, of course, increase as the compression is made between limits; that is, the tension will be less at the moment the triple piston begins to compress it than when compressed to full emergency position. These tensions can best be found by taking the cap off a triple valve, and with ordinary weighing scales compress the spring. Perhaps it may be information to say that the free height, after permanent set of the plain triple graduating spring, is 2½ inches; height under load of 13½ pounds is 1⅞ inches, and the height under load of 24 pounds is 1⅛ inches.

(69) J. B. M., Buffalo, N. Y., writes:

We have quite a number of 8-inch pumps in service on engines that have about 20,000 cubic inches main reservoir capacity, and we can't get enough air. The trains we haul now have more air brakes than two years ago, and then the pumps would supply us. Now we are crowded. We ought to have 9½-inch pumps, but the 8-inch pumps are good yet, and we don't want to throw them away. What ought we to do? Please answer. A.—The Westinghouse Air-Brake Company allows a credit of $15 on the 8-inch pump in exchange for the 9½-inch. As the 8-inch pumps are in good shape yet, you might put on another reservoir of the same capacity. This would let you wear out the 8-inch pump and tide you over until you put on the 9½-inch pump.

(70) G. J. C., Collinwood, O., writes:

I leave the roundhouse with engine, with 70 and 90 on the air gage, with everything in good condition, and after coupling on to a train of forty or fifty cars of air, the air gage will show only about 65. Then again, engine will couple on to another train of same number of air cars, and will again show 70 and 90. This question some of our practical air-brake men here have been unable to answer. A.—As the train pipe pressure gradually rises and approaches 70 pounds, for which the feed valve is set, the supply valve gradually approaches its seat, nearing it closer and closer. If your train is free from leakage, the supply valve will finally reach its seat and close the feed to the pipe, giving you 70 pounds. It is possible, however, to have a degree of leakage from the pipe which will not allow the supply valve to seat, but will hold it just unseated to supply the leak. The degree of leakage will determine whether this will hold the train line pressure at 65, 68 or 69 pounds.

(71) S. J. B., Cleveland, O., asks:

Which is the most practical way to find if the ring in the equalizing piston leaks? Some of our engineers have different opinions about finding the leakage. A.—There is more or less leakage past all single packing rings, it being impossible to make an absolutely tight fit with one ring. One way to detect leakage past the ring is to make a considerable reduction in service position on a long train, and note whether the black hand rises when valve is returned to lap. To determine it more accurately, cut out and bleed tender and driver brakes, pump up main reservoir, chamber D and train pipe of engine and tender. Exhaust pressure from chamber D and the train pipe. Then immerse hose at back of tender (stop-cock being open and brake valve on lap) in a bucket of water. If bubbles rise, the rotary leaks. Pump up again, place valve on lap and exhaust the air from the train pipe at the hose as before. Again immerse the hose, and if more bubbles form than before (and there probably will be, unless chamber D has already emptied itself), the increase in bubbles over the previous test is due to the leakage past the ring.

Putting Water on Hot Bearings.

A special committee appointed by the Traveling Engineers' Association, consisting of J. F. Walsh, C. H. Hogan, P. H. Stack, L. Gleason and Chas. Davis, reported as follows.

"Your committee appointed to consider the use of water on hot bearings beg leave to report that its use in such emergencies is to be commended, the sense of its use to be the same as the application of an anesthetic to a person suffering, namely, a temporary relief.

"We further advise that engines assigned to limited service, either passenger or freight, be equipped in such manner as to permit a flow of cold water to the various journals.

"In the absence of some practical method of allowing the cold water to reach the lower side of the engine truck or driving wheel journals, we advise that the water to those journals be permitted to flow on to them at the outer end of the journals, namely, between the wheel hub and the driving box or engine-truck box, and at the inner end of the journal.

"We further recommend that at the very earliest opportunity the troublesome bearing or journal be given attention at the shops, so that the use of water upon it or them may be discontinued."

The new catalogue of the Watson-Stillman Company, 204 East Forty-third street, New York, deals principally with hydraulic jacks. It gives an idea of the great variety of jacks they make, and it is hard to think of any kind of work which cannot be satisfactorily handled by some of them. The directions for using and repairing are excellent, and are sure to be valuable to those handling jacks. To all such we suggest sending for one of these catalogues.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(92) R. T. Y., Newburg, N. Y., asks:

Who first used the link motion in this country? A.—This is somewhat of a disputed point. Some credit it to James, before being used on the other side. Thomas Rogers, of what is now Rogers Locomotive Works, however, deserves the lion's share of credit for his persistence in using it in the face of great opposition. He was an early, as well as an earnest, advocate of its use, and its universal adoption to-day shows that his opinion regarding it was correct.

(93) G. W. B. asks:

How can we estimate the speed at which an engine is moving at slow speeds for short distances? When we run far enough to count the telegraph poles or use the mile-posts it is an easy matter, but for less than a mile we cannot get it reliably. A.—If the tracks are laid with 30-foot rails, there are 176 of them in a mile. If you run 20 miles an hour you will run over 176 rails in 180 seconds, or 3 minutes; that is close to one rail length a second. So if you pass over 10 rails in 20 seconds it will be 10 miles an hour; 4 rails will be 4 miles an hour. Count the rail joints for 20 seconds and you can get within a close fraction of the exact speed.

(94) H. R. K., Pittsburg, Kan., asks:

How can I figure weight of rails per mile? A.—Multiply the weight per yard by 3,520 for a single-track road and by 7,040 for a double-track road. This gives weight in pounds. For example, if the rail weighs 100 pounds per yard it weighs 10 times this (10 yards, or 30 feet, in a rail), or 1,000 per rail. Two rails for single track weigh 2,000 pounds, or one ton for each rail length of 30 feet. 5,280 feet divided by 30 equals 176 rail-lengths per mile, and one ton times 176 equals 176 tons per mile. Reckoning by pounds, we have $3{,}520 \times 100 = 352{,}000$ pounds. Dividing by $2{,}000 = 176$. Or, multiply weight per yard by 1.76 for tons per single-track mile. With 60-pound rail we have $60 \times 1.76 = 105.6$ tons per mile.

(95) T. A. S., Clinton, Ia., says:

Several of us have had an argument about adhesion. I claim that it is best to have just as few drivers as will do the work. Others claim that by coupling up three pair you can do better work, even on a light train. A.—We think you are right. Single-driver engines (so called) run remarkably free, owing to the absence of side rods. Any train they can start without slipping they handle just as well as a ten-wheeler. Until your main drivers begin to slip the others are only helping to carry the load; when the main drivers would slip (if they were the only ones) the coupled wheels take hold and help do the work. Any train a single driver can get under way it can handle better and easier than an engine with coupled wheels.

(96) F. C. S., Kansas City, asks:

1. What is the ratio used between the cylinders in compound locomotives? A.—1. This varies with the maker and also the conditions, such as steam pressure and service. A common ratio is $2\frac{1}{4}$ to 1, in which the diameter of the low is always $1\frac{1}{2}$ times that of the high. For example, a 20-inch high and a 30-inch low pressure cylinder. Some of the Vauclain (Baldwin) four-cylinder compounds have ratios as high as 2.9 to 1, but it is usually $2\frac{1}{2}$ or 2.3. 2. How do you find the ratio between them? A.—2. Divide the area of the low pressure cylinder by the area of the high. It is not necessary to find the area, however, and unless you have a table of areas handy it is easier to square the diameter of each cylinder and divide the square of the low by that of the high. For example, take a 20-inch high and 30-inch low pressure cylinder. $20 \times 20 = 400$, $30 \times 30 = 900$. 900 divided by 400 equals $2\frac{1}{4}$.

ERECTING BALDWIN LOCOMOTIVES IN CHINA.

From Photograph sent by the late F. M. Stevens.

(97) M. K. T. says:

When I began running a locomotive, twenty years ago, an engineer would be discharged if he did not disconnect the main rod in case an engine was disabled on one side. Now it is not unusual to see disabled engines coming in with the valve motion disconnected on one side and the main rod still coupled up and the piston moving in the cylinder. A.—Train movements cannot stand the delays now that they allowed twenty years ago, and in forcing disabled engines under way in the quickest way possible, it has forced men to take risks that they did not at one time consider safe. Repeated trials have shown that a great many methods of disconnecting are just as safe as is necessary to get the machine off the main line, and they were then sent on to the shop in that condition. With the very heavy engines of to-day, taking down the main rod and blocking everything is a big job; it is easier to take out cylinder cocks or slack off front head and place the valve so the exhaust port takes care of the steam or air in the back end of the cylinder; then proceed slowly with the piston still moving. This is a question which calls for a display of good judgment and knowledge of the construction of an engine. The engineer of to-day has these qualifications.

Service Stripes for Baltimore & Ohio Railroad Men.

There are many uniformed employés of the Baltimore & Ohio Railroad who have spent the better part of their lives with the company, but very few people are aware of their length of service and devotion to duty that have made them valued men. General Manager Underwood will shortly issue an order providing for service stripes for these men that the public may know of their faithfulness and ability.

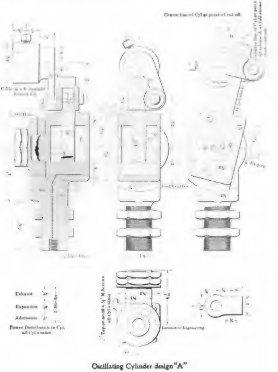
A gold stripe will mean five years of service, and a silver stripe two years. Some of the Baltimore & Ohio conductors will be entitled to from seven to nine gold stripes.

The company will also furnish conductors, brakemen and baggagemen of all classes with badges, so that they may be easily distinguished by those unfamiliar with the service.

Waddell Bell Ringers.

These designs have been submitted to us by Mr. P. Emerson Waddell, of New York city, and they certainly have the merit of simplicity. They need little or no explanation.

It is but just to say that the blueprints from which these were made are about the neatest specimens of drawing we have seen, and Mr. Waddell is to be congratulated on his ability as a draftsman.



Oscillating Cylinder design "A"

WADDELL'S DESIGNS FOR BELL RINGER.

H. B. Underwood & Co., successors to the L. B. Harders Machine Works, have sent us a very neat penwiper surmounted by a celluloid button. This shows the medal which was awarded them by the National Exposition of Railway Appliances in 1883 for their "Tools for Repairing Locomotives." These have been improved since that date, and continue to be favorites with railroad shop men. The penwiper will, we believe, be sent to any railroad official on request.

At the Traveling Engineers' Convention

W. S. Morris, superintendent of motive power on the Chesapeake & Ohio Railway, in his address before the Traveling Engineers' Association, among other bright facts, said that "the locomotive of to-day can be safely credited with a goodly share toward the cheapening of transportation and the very high efficiency attained in fast passenger service. Think of handling a ton of freight one mile for one-third of a cent; it now seems reasonable to believe, but ten years ago it would have been very much doubted. I cannot say that the owners of railroad properties are not entitled to better treatment in the way of increased freight rates; but what are you going to do about it? It is all we can get. Therefore, the cost of operation must be reduced to a comparative standard with the earnings, and every one of us must find some way of saving a mite from the former expenditures to make up the total saving required.

"The wage standard should not be lowered for good pay makes good servants, so we turn to the volume of tonnage, and with the wage at a standard per capita, in the increased volume of tonnage hauled and the wastes corrected we find a partial solution of the problem.

"You, gentlemen, have realized how this has been worked out in detail in the mechanical departments. The 35-ton locomotive has been replaced by the 90 or 100-ton machine. The compound locomotive is saving the coal, the larger capacity cars have concentrated the load, and the performance of each man is carefully recorded; the extra pint of oil, the extra ton of coal and the extra stores used must be explained, when in excess of the average used; and the road foreman of engines is called to work out the corrections, where in any way the engine crews are responsible.

"Just think of the changes that have come about in the few years of the existence of this association, and while we must of right concede to the individual his own share of personal advance, under the pressure of the additional requirements, yet the interchange of practical experiences, enhanced through the advantages of an organization of this kind, has indeed refined and educated the many, where, without this interchange of ideas, we would still be groping about on many a railroad with the one-man idea as of old. The road foreman of engines or traveling engineer has a most trying position to fill. He must understand not only the care and treatment of the very highest type of motive power in service, but he must understand transportation methods, accounts, modern discipline, and, in fact, he is expected to be all that goes to make up a good executive officer, familiar with every detail of his line in his district; and the tact with which he must handle himself as a go-between or interlocker between the mechanical and transportation departments, in order to promote harmony, is not always an easy accomplishment; but still, in every traveling engineer or road foreman of engines, it is a requisite. This is an age of specialties, and to the specialist we look for a more thorough knowledge and likelier corrections than from the general practitioner; hence the road master and train master, the traveling engineer or road foreman of engines has come to be recognized as a necessary specialist of a very high character, and from this class will come the selection, in many instances, for the higher officers."

President McBain said, among other things:

"I wish to congratulate the members and to compliment the different committees upon the splendid reports provided upon the subjects we have before us. It is my pleasure to report to you that the association is in a very healthy condition,

financially and otherwise—a fact that I know will please you.

"In the past year, since the convention of 1898, our membership has increased from 224 to 257, and we have enrolled upon our list of membership the names of some very progressive men; nor are we going to quit at that. They are coming in all the time, and I feel proud of the association and its progress.

"There have been removed by the hand of death in the past year four of our members, in the persons of J. W. Shannon, of the Westinghouse Air-Brake Company; P. P. Egan, of the Galena Oil Company; J. E. Baines, of the Denver & Rio Grande Railroad; E. M. Johnson, of the Westinghouse Air-Brake Company, upon whose death the usual Committees of Condolence have been appointed.

"I will take this opportunity of recommending that hereafter not more than five subjects be taken up for discussion at each meeting. I do this because I feel that five subjects properly discussed are about all the membership of this association can do justice to.

"I wish also at this time to impress upon each of you the urgent necessity of all taking part in the discussions, as that is what makes the convention worth attending, and if they are left in the hands of a few, and that few does all the talking year after year, we will soon be in what is practically a one-opinion rut.

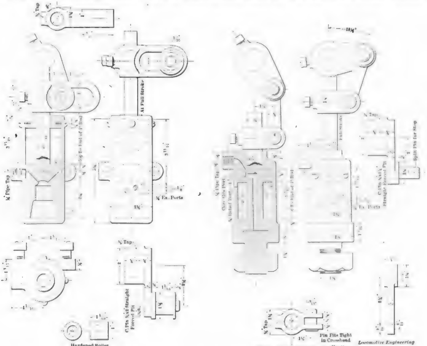
"The topical, or 'noon-hour,' discussions should receive as much of your attention as you can give them. There are many points brought out in those discussions that are as valuable as those discussed before the convention. There are no members of this association but can say something that will be of interest to some other member, and if we wish to perpetuate the usefulness of the institution we must give our opinions freely.

"I am going to take the liberty of commenting to some little extent on the subjects to be discussed:

"'The Use of Water on Hot Bearings of Engines or Tenders; Is It Advisable, and to What Extent?' There should be no lack of opinion, and I also believe that some interesting experiences can be related. In discussing this subject we should not lose sight of the following facts: We have not yet got to that point of perfection when all bearings run cool all the time. The railways of this continent have certain obligations to fulfil to the people who ride on their trains, many of whom are important factors in carrying on the commerce of the nation, and to whom a delay of an hour or two means the loss of thousands of dollars. The facts of the matter are, the people must not be delayed more than is absolutely necessary. This is also true of the United States mail trains and important perishable freight trains.

"A little stream of water in a tender journal box or driving cellar will avoid delay to important trains, and it occurs to me that in the absence of something better, we, as an association of practical railroad men, should at this time consider the matter very thoroughly and devote our efforts to heading off the abuse and not the use of water on hot bearings.

"On the second subject, 'Long Runs of Engines, with a View of Economical Treat-



Piston Port Design "B"

Piston-Rod Port Design "C"

WADDELL'S DESIGN FOR VALVELESS BELL RINGERS.

ment and Handling,' I would suggest that in discussing this we go into the matter with a view of overcoming any little difficulty that may beset the plan, rather than with the idea that it is not as good as the old arrangement. If the gentlemen at the heads of our corporations determine that it is to the commercial advantage of their companies to make long runs with locomotives, we as practical men in the business must go at the thing right—that is, with a determination to surmount any difficulty that we may encounter. If we do this, it will be surprising to us how little the objections to the plan really amount to.

"We should be as broad-gaged as possible in discussing 'How Can the Responsible Engineer Be Located, when an Engine Had Been Subjected to Unfair Treatment Under the Pooling System?' and not put ourselves on record as being in favor of any very drastic measures. I would rather try and improve on the rules now governing the pooling of engines, so that if an engine were subjected to unfair treatment, it would be found out before the culpable man turned the engine over to anyone else.

"On the subject of 'Boiler Purges and Compounds from the Standpoint of the Traveling Engineer,' I wish to say that the subject should get a fair discussion, not with a view of pointing out the disadvantages attending the use of it on account of boilers foaming, etc., as those things can be taken care of by a system of blow-off cocks and a proper code of rules for their manipulation; but, as I see it, the question is, 'Is the use of boiler purge or compound the means of prolonging the life of the boiler?' There are, I believe, in this room men who can add a lot of information in the way of experience to the report of the committee, and I trust that these experiences will be given to the convention while discussing this subject.

"We should make an effort to lay down a plan to 'head off' that everlasting trouble, the hot air pump. We should try and devise a plan whereby that great cause of annoyance and inconvenience would be lessened, if not eradicated entirely. We all know that brakes are sometimes charged with sticking, when in reality the trouble was the direct result of 'easing off' on the pump to make it last the trip out, thus allowing the pressure in the train line to fall a little below the point at which all triples would be held in release position.

"Then there is the common report on the work book, 'Engineer's valve needs cleaning.' If those things are cleaned every time they are reported as needing it, they would be about the cleanest thing about a locomotive that we know of. Is it not often the case with the D-5 or E-6 valve that the stem on the lower end of the feed valve is worn off too short, or perhaps it has dug a hole in the end of the main piston of the feed valve, so that there is not left enough to insure the proper opening under the feed valve to supply a train?

"'The Brown System of Discipline' is a heavy subject, and in discussing it we should consider well the merits and demerits of the plan. The object of this association is, to improve the locomotive service on American railroads, and if we can determine to our own satisfaction that this can be done better under the Brown system than any other, then let us, as an association of men who know the disadvantages of the old plan, both to employé and employer, put ourselves on record as being in favor of it.

"I would also respectfully urge that the members of this association do not, on account of the season of prosperity we are now enjoying, allow their vigilance to relax along the lines of economy in the use of fuel and supplies.

"In order to keep up with the times, we must not allow any opportunity of getting practical information in our line of business to pass. I find it a good plan to converse with my firemen occasionally. I get information from them as to how the different engines are doing, and, when the engines are pooled, it has been my experience that the condition of the engine, so far as steaming and fuel consumption are concerned, can be kept better in hand in this way than in any other. The firemen are directly interested in this, even though they only have the engine for one trip; while in the case of the engineer, in many instances at least, as long as he has all the steam he needs to do the work, he is not particularly interested in the question as to whether the steam comes easy or hard.

"In conclusion, I wish to thank you all for the honor you have bestowed upon me by keeping me at the head of the association for two years, and for the loyal support you have given me during that time."

NEW MOGUL FOR NEW YORK CENTRAL.

New York Central Mogul.

Increasing business demands larger motive power equipment, and the engine shown herewith has recently arrived on the New York Central & Hudson River Railroad from Schenectady Locomotive Works.

The main dimensions are given below:

Weight, total—150,000 pounds.
Weight on drivers—129,000 pounds.
Cylinders—20 x 28 inches.
Valve travel—5½ inches.
Driving wheels—57 inches.
Driving journals—9 x 12 inches.
Main crank pin—6 x 6 inches.
Truck journals—6¼ x 12 inches.
Truck wheels—30 inches.
Boiler, diameter—66¼ inches.
Working pressure—190 pounds.
Firebox—108 1-16 x 40⅞ inches.
Tubes—353 2-inch.
Tubes, length—12 feet.

Heating surface, tubes—2,202.5 square feet.

Heating surface, firebox—185.8 square feet.

Heating surface, total—2,388.3 square feet.

Grate surface—30.3 square feet.

The equipment consists of two No. 9 Monitor injectors, American balanced valves, United States metallic packing, Westinghouse-American brakes, 9½-inch pump, Nathan No. 9 triple sight-feed lubricator, Houston sander.

Pattern Storage.

One of the neatest store-houses for patterns that we have seen is that of Messrs. Beaman & Smith, in Providence, R. I. This is of the modern slow-burning construction, with convenient racks for patterns and hoist for raising heavy patterns to the upper floors.

The danger of windows being left open is avoided by having them all fastened solidly in place, and ventilation is obtained in a novel way. The floor is several inches above ground and open underneath. In the center is a large opening, covered with fairly heavy wire netting and provided with a trap door which can be closed when desired.

The stairs are also in the center of the building, over the air space, and, being open, the air circulates up through the building and out of two ventilators at the top. These are toward the end of the top floor, so the air cannot go directly out the top over the air shaft. The building is covered with pressed steel and presents a good appearance. It is well worth examining by those who are to build a store-house or similar building.

As the long nights are now upon us and men have time for reading, we wish to direct attention to our book of books. It is a good guide for people looking for books on railroad and engineering subjects. Send for it.

Cooke Locomotive for Oregon Short Line.

The locomotive here shown is one of eighty ten-wheelers recently built by the Cooke Locomotive & Machine Company, of Paterson, N. J., for the Oregon Short Line.

The engine has cylinders 20 x 28 inches, and driving wheels 57 inches diameter. The boiler carries a pressure of 200 pounds to the square inch, which makes the tractive power about 34,000 pounds. The total weight of the engine in working order is 171,000 pounds, of which 143,000 pounds are on the drivers.

Among the special equipment of the engines are: Cast-steel wheel centers, Midvales tires, Taylor iron driving axles and crank pins, cast-steel driving boxes, cast-steel cross-heads, carbon-steel plates, New York air brakes, steel cab, Ashton safety valves, Leach sanders, Gollmar bell-ringers, Nathan lubricators.

COOKE TEN-WHEELER FOR OREGON SHORT LINE.

The following are the principal dimensions not before given:

Total wheel base of engine—23 feet 10½ inches.

Driving wheel-base—13 feet 6 inches.

Wheel-base of engine and tender—52 feet 1½ inches.

Driving axle journal—9 x 12 inches.

Engine truck axle journal—5½ x 10 inches.

Boiler:
- Type—Crown bar, wagon top.
- Diameter first course—68 inches.
- Firebox, length—113 inches.
- Firebox, width—38¾ inches.
- Tubes, number—342.
- Tubes, diameter and length—2 inches diameter, 13 feet 3 inches long.
- Thickness of shell—¾ inch.
- Heating surface, tubes—2,353 square feet.
- Heating surface, firebox—185 square feet.
- Heating surface, total—2,538 square feet.
- Grate surface—30 square feet.

Slide valve—Richardson-Allen.

Slide valve travel—5⅞ inches.

Steam ports—1⅝ x 18 inches.

Exhaust ports—3¼ x 18 inches.

Lap—1-16 inside, 15-16 outside.

Exhaust pipe—Low, double nozzle.

Center of boiler from rail—8 feet 3½ inches.

Top of stack from rail—16 feet 8 inches.

Tender:
- Frame—10-inch steel channels.
- Truck, style—Fox, pressed steel.
- Truck wheel—33 inches diameter.
- Truck axle journal—5 x 9 inches.
- Tank, water capacity—4,500 gallons.
- Tank, coal capacity—10 tons.

At the Export Exposition.

The gigantic industry that is represented in the Transportation Building, one of the group of colossal structures which constitutes the home of the National Export Exposition at Philadelphia from September 14th to November 30th, possesses a deep interest, in view of the great progress that has been made in recent years in all that pertains to traffic by rail.

The Transportation Building was carefully designed for the exhibits of locomotives and railroad rolling stock, electric cars and equipment for electric railways. It is 450 feet long and 75 feet wide, and the trackage, available for exhibits of rolling stock, which the building contains, is connected with the Philadelphia, Wilmington & Baltimore Railroad, a part of the Pennsylvania Railroad system. The building affords every advantage for the handling and disposition of these heavy displays, and there are representative displays by leading American manufacturers.

The Baldwin Locomotive Works exhibit two locomotives which will be changed at intervals, showing the different types and latest improvements in locomotive construction. The Richmond, Va., Locomotive Works also make a good exhibit. There is a large display of street cars of the trolley type, together with trucks for

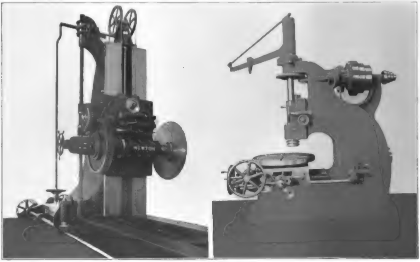
street and steam railway cars; an exhibit of freight cars and refrigerating cars, Pullman Palace cars and pressed steel cars; extensive exhibits of car wheels, rails, switches, frogs of the latest patterns and all kinds of steam and electric railway supplies.

Two Heavy Tools.

The cold sawing machine here shown is said to be the largest yet built, and the dimensions given leave little doubt on this score. It has recently been completed by the Newton Machine Tool Works, Inc., of Philadelphia, for the Bethlehem Steel Company, of South Bethlehem, for use on armor plate work. When it is considered that the saw is 50 inches in diameter, the size of the whole machine becomes more apparent.

The saw spindle is 11 inches in diameter and has a transverse motion of 30 inches. The head moves 8 feet vertically on the upright, and the upright has a movement of 20 feet on the bed. There is power feed in all directions and a quick return, by power, in all cases. The machine weighs 100,000 pounds, and an auxiliary bed plate weighs 30,000 pounds more.

The vertical mill is also a remarkably heavy tool, and was built for the Brooks Locomotive Works. The spindle is 7 inches in diameter, circular table 42 inches and will swing 56 inches clear of the upright. It is back geared, weighs 20,000 pounds, and, as will be seen, has a swing crane for handling its own work.



LARGEST COLD SAW YET BUILT. TWO HEAVY TOOLS. VERTICAL MILLING MACHINE.

Painted Jackets.

We notice that the practice of painting the jackets of locomotive boilers is on the increase, and on many roads instead of the glossy Russia iron jacket we now see a thin steel jacket over the lagging, which is painted black. This, of course, means less work for the fireman to keep it polished, and less expense for the material used.

In some cases there is a complaint that these painted jackets rust out from the inside in less than half the life of a Russia iron jacket not painted. It is hard to understand how painting the outside will affect the rusting on the inside, but good observers state this to be a fact. If these jackets are painted on the inside with red lead before being applied to the boiler, they will not rust out. At least this is the practice of our English cousins, who have always painted the jackets outside. Possibly it is necessary to keep the air away from both sides of the sheet to ensure lasting qualities.

The American Locomotive Sander Company are fast getting their shop in shape for business and report a good demand. They make the Leach, Houston, Dean, "She" and Curtis, and as the price of each has been made the same, it should enable them to decide on the merits of the various sanders. As the need of good sanders is constantly increasing, there seems to be every promise of a prosperous business.

Hydraulic Jack Hints.

The Watson-Stillman Company give some good advice concerning jacks in their new catalogue, from which we extract the following:

For summer use fill with 1 part alcohol and 4 parts water. In winter use 2 parts alcohol to 3 parts of water.

Never fill with water, kerosene or wood alcohol. Water rusts (if jack is unused): kerosene destroys the packing, and wood alcohol destroys cylinder and ram.

One man of ordinary weight can apply all the force on the lever which they are designed to stand. It is intended the lever should bend or break when more than 150 pounds are applied to it.

For other directions we refer to their latest catalogue.

Engineers and mechanics from all over the country are interested in the peculiar locomotive wreck now at the Allegheny shops of the Ft. Wayne. Class I consolidated engine No. 412, built at these shops for the E. & P. Railroad in 1890, is standing on one of the tracks with her dome missing and the Belpaire firebox and boiler head ripped to pieces, with all the staybolts exposed. The 5/8-inch steel plate is cut as clean as if it had been ripped by a knife and spread far apart, and the entire wreck is covered with crushed limestone. This engine ran into a limestone tipple on the P., Y. & A. division and the dome was knocked off, causing an explosion, in which the engineer and fireman were seriously injured.—*Pittsburgh Post.*

PERSONAL.

We wish to acknowledge the obligations to our club agents and other friends for the personals which they are kind enough to send us in the early part of each month, relating to official changes in the mechanical departments of the roads they belong to. September was a very hot month in a great many parts of the country, and we must attribute to the heat the lack of zeal on the part of our agents who are in the habit of sending these personal notices. We received very few in the month of September. We would remark, in passing, to our friends, do not falter in the good work.

Mr. C. C. Farmer has been appointed general air-brake inspector of the Central Railroad of New Jersey.

Mr. J. M. Ward has been appointed master mechanic of the Galveston, Houston & Northern, with office at Houston, Texas.

Mr. Samuel Potts has been appointed master mechanic of the Los Angeles & Redondo at Redondo, Cal., vice Mr. W. N. Best, resigned.

Mr. B. F. Pilson, for a number of years Southern representative for the Ajax Metal Company, has been appointed general contracting agent.

Mr. John H. Kiesling has been appointed master mechanic of the Gulf, Beaumont & Kansas City at Beaumont, Texas, vice Mr. F. G. Papineau.

Mr. H. E. Hutchens, superintendent of the Atlantic & Danville, has been appointed superintendent of the Danville division of the Southern at Norfolk, Va.

Mr. Thos. Burns has been appointed assistant master mechanic of the Chicago, St. Paul, Minneapolis & Omaha at Sioux City, Ia., vice Mr. J. K. Brassill, resigned.

Mr. W. P. Dittoe has been appointed purchasing agent of the New York, Chicago & St. Louis, office at Cleveland, O., succeeding Mr. M. M. Rodgers, resigned.

Mr. John McFarlane has been appointed assistant superintendent of the Kansas division of the Union Pacific at Ellis, Kan., in place of Mr. W. H. Petersen, resigned.

Mr. Lewis Greaven has been appointed locomotive and car superintendent of the Interoceanic Railway of Mexico, at Puebla, Mex., in place of Mr. H. E. Walker, resigned.

Mr. L. C. Fritch has been appointed superintendent of the Mississippi division of the Baltimore & Ohio Southwestern at Washington, Ind., succeeding Mr. H. C. Barnard, resigned.

Mr. N. Diefenderfer has resigned as general foreman of the Elizabethport shops of the Central Railroad of New Jersey, to accept a position with the Erie at Stroudsburg, Pa.

Mr. Oliver Galbraith, general foreman of the machine department of the St. Louis Southwestern at Pine Bluff, Ark., has accepted a similar position with the Wabash at Springfield, Ill.

Mr. Charles Hine has resigned as trainmaster of the Chicago division of the "Big Four," to accept the position of general superintendent of the Findlay, Ft. Wayne & Western at Findlay, O.

Mr. A. W. Trenholm has been appointed superintendent of the Nebraska division of the Chicago, St. Paul, Minneapolis & Omaha at Omaha, Neb., vice Mr. H. S. Jaynes, assigned to other duties.

Mr. John Hair, master mechanic of the Baltimore & Ohio Southwestern at Chillicothe, O., has been transferred to the Mississippi division at Washington, Ind., succeeding Mr. C. E. Walker, resigned.

Mr. S. G. Strickland has been appointed assistant superintendent of the St. Paul and Sioux City divisions of the Chicago, St. Paul, Minneapolis & Omaha at St. James, Minn., vice Mr. W. C. Winter, transferred.

Mr. Henry E. Walker, locomotive superintendent of the Interoceanic Railway of Mexico, has resigned to accept the position of assistant works manager in Messrs. Beyer, Peacock & Co.'s locomotive works at Gorton, Manchester, England.

Mr. Frank J. Smith, foreman of the shops of the Baltimore & Ohio Southwestern at Seymour, Ind., has been appointed master mechanic of the Ohio division, with headquarters at Chillicothe, O., succeeding Mr. John Hair, transferred.

Mr. W. J. Miller, master mechanic of the Kansas City, Pittsburgh & Gulf at Shreveport, La., has resigned to accept the position of foreman of shops of the St. Louis Southwestern at Pine Bluff, Ark., in place of Mr. O. Galbraith, resigned.

Mr. W. C. Winter has been promoted from the position of assistant superintendent of the St. Paul and Sioux City divisions of the Chicago, St. Paul, Minneapolis & Omaha, to that of superintendent of the Northern division at Itasca, Wis., vice Mr. A. W. Trenholm, transferred.

Mr. W. G. Brimson has been appointed general manager of the Omaha, Kansas City & Eastern and Omaha & St. Louis, with office at Quincy, Ill., vice Mr. H. S. Rearden, resigned. Mr. Brimson was formerly president and general manager of the Chicago, Lake Shore & Eastern.

The following changes have been made on the Wheeling & Lake Erie: Mr. J. E. O'Hearne has been appointed master mechanic of the Toledo division, with headquarters at Norwalk, O., and Mr. John Bean has been appointed master mechanic of the Cleveland division, with headquarters at Canton, O.

Mr. Robert Rennie, engineer of tests of the Richmond Locomotive Works, has been appointed general foreman of the Lehigh Valley shops at South Easton, Pa. Mr. Rennie is a young man of much promise, and is spoken of in the highest manner by those who know him best and by his employers.

Isaac H. Congdon, for many years superintendent of motive power of the Union Pacific until 1885, when he resigned, died at Omaha last month, aged sixty-six. Mr. Congdon was a man of great executive as well as mechanical ability. His name is perhaps best known to the railway world as the inventor of the Congdon brake shoe.

President Clark, who has done so much to advance the interests of the New York, New Haven & Hartford Railroad, has been in poor health for several years, and has intimated that he would resign the presidency. We have several times heard the name of Mr. G. W. Stevens, of the Chesapeake & Ohio, mentioned as a successor to Mr. Clark.

Officers of Traveling Engineers' Association.

On the last day of the convention of the Traveling Engineers' Association the following were elected officers for the ensuing year: President, P. H. Stack, of the Union Pacific, Omaha; vice-presidents, C. H. Hogan, New York Central, Buffalo; W. G. Wallace, Chicago & Northwestern, Baraboo, Wis.; H. B. Brown, Baltimore & Ohio, Newark, Ohio; treasurer, C. A. Crane, Santa Fé, Madison, Iowa; secretary, W. O. Thompson, Lake Shore, Elkhart, Ind.; member of Executive Committee, W. J. Walsh, of Cleveland.

The following subjects were selected for discussion at the next annual meeting at Cleveland:

1. "What Are the Best Methods to Secure Good Results in Smokeless Firing?"
2. "The Use of the Steam Indicator."
3. "What Can Traveling Engineers Do to Lessen Engine Failures Caused by Leaky Flues on High-Pressure Engines?"
4. "How to Pack Boxes and What Is the Best Kind of Waste to Insure the Most Perfect Lubrication of Bearings?"
5. "Tank Valves, Goose Necks, Hose Strainers and Suction Pipes."

When a rich man dies in America there is a certain portion of the public press that vie with each other in heaping contumely on the memory of the departed. A notable exception to this has been the attitude of the entire press concerning Cornelius Vanderbilt, who died last month. Mr. Vanderbilt appeared to have no enemies, and there never was any imputation that he used the great power residing in vast wealth to do any injustice to rivals or others. His career was that of a modest, upright, honest Christian gentleman who acted in a quiet, unostentatious way to make the world the better for his existence. When Mr. Vanderbilt was born, his father was a farmer, and he spent the

first sixteen years of his life on a farm. The sterling independence which he displayed when earning his own livelihood indicated that he possessed the qualities which push men to the front. If he had not inherited wealth he probably would have made a greater stir in the world than he did.

Nervous About His Trunk.

Most of our readers are probably aware that the baggage of railway travelers in Europe is not controlled by a check system. Each piece has an adhesive label pasted upon it, indicating the station where it should be taken out, and the owner claims it at the end of his journey. This calls for considerable supervision of the baggage by travelers. Some nervous people are always watching at every stopping place to see that their baggage is not put out by mistake.

The story is told of a traveler going from Glasgow to Aberdeen, who was haunted with a dread of losing his trunk. He saw it put into the luggage van at Glasgow, and enjoined the man in charge not to put it off until they reached Aberdeen. He also did his best to impress upon the guard the important responsibility that would rest upon him if the trunk got lost.

At the first stopping place he got out, and, finding the guard, asked: "Are you sure my trunk is all right?"

"Yes, it is all right; take your seat."

This was repeated at every stopping point, till the guard got fatigued with the questioning, and began trying to avoid the man.

When the journey was nearly over the nervous man made a persistent chase of the guard, caught him by the arm, and exclaimed: "Now, guard, are you perfectly certain that my trunk is all right?"

"Yes," was the fiercely uttered reply. "It's a pity that the Lord didna mak' an elephant o' you instead of a jackass, for then you wad ha'e carried yer trunk along wi' you."

Trains Behind Time.

There has been considerable discussion of late in British papers about the want of punctuality in running express trains. It seems that on certain lines the schedule is more for appearance than for use. Referring to a published complaint from Lord Robert Cecil against the London, Chatham & Dover trains' want of punctuality, the *Railway Herald* says:

"The engines are not strong enough to climb the banks along the route. There is not the least doubt that locomotives similar to those in use on the Caledonian are badly needed on the Chatham, and under present circumstances, the only course to be pursued seems to be to discard the Chatham locomotives on the Dover line and work the traffic simply with the express engines from the works at Ashford, over which Mr. H. S. Wainwright, of the South-Eastern, presides. These will enable the Chatham to cope with the exceptional difficulties of her mountainous road."

In striking contrast to European trains are now most express trains on American railways. The writer recently made a tour of nearly 7,000 miles, stopping off at numerous cities. In only one case did he find a train more than ten minutes late, and that was caused by a hot box.

OFFICERS OF TRAVELING ENGINEERS' ASSOCIATION.

Increase of Railway Travel.

Passenger business on all the roads centering in Chicago has been exceptionally heavy this summer. Some of the roads compare it with the World's Fair year, stating that it is as great in both volume and receipts. The intensely hot weather can be, in a measure, credited for the increased summer-resort business, although Americans as a rule are much inclined to lay off from business cares at this season. One goes, and the example sets others out on the same quest for relaxation. The American push for business and the desire to enjoy its profits send more of us over the railroads every year.

In many cases it is a hard matter to get equipment to handle the business properly; when there is any special rush, the coaches are crowded.

All of this points to but one conclusion—more passenger equipment must be built or bought by the railroads in the near future in order to keep pace with the increase of travel, which in this growing country promises to be a permanent one.

New Pennsylvania Ten-Wheelers.

The Pennsylvania Railroad are getting out some new ten-wheelers for heavy passenger service in the western part of the State. Part of them will have 72-inch wheels, while the others will be 62 inches, the former being known as class G4, the latter as class G4a. Otherwise, they are alike. They are not yet far enough along to illustrate, but some of the leading dimensions are given below:

Cylinders—20 x 28 inches.

Main driving axles—9½ x 13 inches.

Flues (2 inch)—356.

Total heating surface—2,814.63 square feet.

Grate area—30.8 square feet.

Ratio grate to heating—1 to 91.3.

Belpaire wagon top boiler—225 pounds steam.

Tractive power per pound, M. E. P.—G4, 155.5 pounds; G4a, 180.6 pounds.

Total at 80 per cent. boiler pressure—G4, 27,990 pounds; G4a, 32,508 pounds.

Rigid wheel base—13 feet 10 inches.

Total wheel base—25 feet 5 inches.

Valve travel—6 inches; lap—1 inch.

We learn from President Calloway that the New York Central Railroad Company are about to begin ballasting with broken stone all parts of the main line now ballasted with gravel. The officials are doing all in their power to promote the comfort of passengers, and the stone gravel will be employed because it is free from dust. They are laboring to reduce the annoyance of smoke from the locomotive, and have effected decided improvement.

Australian Consolidation Engine.

A correspondent in Wellington, New South Wales, who sent the photograph from which the annexed engraving was made, writes:

These engines are used for goods traffic over the heavy mountain grades, and haul trains of 440 tons on a grade of 1 in 40, or 2½ per cent. These engines were built by Beyer, Peacock & Co., Manchester; Neilson & Co., Neilson, Reid & Co., of Glasgow, and are all of the same pattern, and are fitted with 9½-inch air pump, air brake on engine and tender, one 8½-inch and one 9-inch, Gresham & Grover injector, Detroit sight-feed lubricator for air pump and engine; firehole door, internally hung, which acts as a baffle or flare plate when door is open. The tender is on double bogies, and carries 6 tons of coal and 3,000 gallons of water. As you will see by the photograph, they are outside cylinder engines. The valves are inside, and are of gun-metal, balanced on same principle as the valves of the Baldwin engines we have in use here. The grades on our lines vary from level up to 1 in 33, and from 100 yards up to 5 miles in length.

The leading dimensions of these engines are as follows:

Boiler—69 inches diameter at smoke-box end.

Tubes—302, 13 feet 4½ inches long, 1¾ inside diameter; brass.

Grate—8 feet 8 inches by 3 feet 6 inches.

Cylinders—21 x 26 inches.

Wheel-base, rigid—15 feet.

Wheel-base, total—23 feet.

Driving wheels, diameter—51 inches.

Length of engine—32 feet 4½ inches.

Length of tender—22 feet 4½ inches.

Total length of engine and tender from buffer to buffer—59 feet 11½ inches.

Steam pressure—160 pounds per square inch.

Exhaust nozzle, single—5⅜ inches diameter.

Steam chest fitted with snifting or relief valves.

Air reservoir placed between frames on front of leading wheels.

Firebox material—Copper.

Firebars lengthwise in box. No rockers or drop grate.

Side rod and big end brasses—Metal lined.

Crosshead—Cast steel.

Wheel centers—Cast steel and steel tires.

Weight of engine and tender ready for the road—105 tons of 2,240 pounds.

AN AUSTRALIAN CONSOLIDATION.

An Austrian chemist, whose name does not appear, has brought forward a device for conveying liquid air, the claim being that, in its adaptability for this purpose, it is an improvement upon all others, especially in preventing evaporation. The fluid is very volatile, and readily absorbs heat from the walls of the vessel which contains it and from the surrounding atmosphere. Heretofore, the plan has been to construct a globular vessel with double walls ½ inch or more apart except at the mouth, where they come together; from the intervening space, air tight, air being carefully exhausted; the vacuum preventing absorption of heat from outside, and acting as an insulator—a little warmth, however, being able to penetrate, evaporation thus occurring. The improvement upon this consists in providing a coating of silver amalgam on the inner surface of the outer wall, this coating serving as a reflector for any heat rays that may fall upon the vessel from outside. In shape this flask is that of two cones placed base to base. Like the globular holder, it must be supported on a ring standard.

Liquid Air.

Recent investigation by Armour representatives as to the utility of liquid air as a refrigerating agent have given negative results. G. B. Robbins, manager of the company's transportation department, and J. E. Smith, mechanical engineer at the packing houses, who visited Prof. Charles Tripler at New York to examine his methods of applying the discovery to cold-producing purposes, have submitted an adverse report to their concern.

"Prof. Tripler's laboratory experiments are very pretty," said Mr. Robbins, "but the use of liquid air for any practical purpose is about where it was a year ago. I am convinced, however, that the substance will find valuable applications in a commercial way before very long. Much able experimentation is being conducted, which must result in the development of means to contain and control the elusive fluid. Its production has already been greatly cheapened."—*Chicago Journal.*

The industries by which markets are supplied and the communications, land or sea, by which these markets are reached have, since 1815, come to depend more and more upon coal. The twentieth century will see a marked increase in the price of the coal of the United Kingdom. Of European Powers, Russia has by far the greatest reserve of coal. India, Australia and South Africa will come to the aid of the British Empire; but the United States must become the center of the world's coal supply, to be, in the far future, perhaps supplanted by China and Japan. How these changes will affect the relative sea-power of nations it would be rash to attempt to predict.

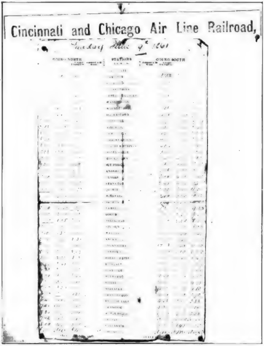
An Old Time Table.

We have been favored by Mr. George M. Bennett, of Aurora, Ind., with a photograph of an old time table in his possession, which is reproduced with this. It needs no explanation, the date and the time in handwriting tell their own story.

Mr. Bennett is the veteran of the Baltimore & Ohio Southwestern, being pretty close to seventy-five years old. He has run on the road mentioned over twenty-three years, and began sitting on the right-hand side about forty-three years ago. He can be seen in the cab of the compound consolidation shown. In all his railroading he has never had an accident worth recording.

MR. BENNETT'S PRESENT ENGINE.

The petty and foolish opposition that early railroad builders were made to encounter seems ridiculous nowadays, and one of the strangest efforts in that line perhaps was that made against the construction of the first road in Germany, between Furth and Nuremburg, in 1836, when the Bavarian Medical College came out in a pronunciamento as follows: "Conveyance by means of a carriage propelled by steam ought to be prohibited in the interests of the public health, for the rapid motion cannot fail to create a disease of the brain among the passengers, which may be classed as a species of delirium furiosum. Even if travelers are prepared to run the risk, the onlookers ought by all means to be protected. The mere sight of a passing train suffices to create the same central disorder."


Cincinnati and Chicago Air Line Railroad,

AN OLD TIME TABLE.

Blacksmith's Hand Hammer.

BY JAS. RAHILLY.

This is not a difficult job, yet no one receives more credit in a shop than he who forges an artistic hand hammer. In fact, it is often the first job a new man is given to do, as a trial of his skill, and sometimes his future in that shop depends on how well it is done.

Select your steel from the best that is kept in stock (1½-inch Jessop is my choice); heat slowly and uniformly, and don't hurry. When it is an orange color take it to hammer and smash down to 1 1-16 inch thick for about 2½ inches, as shown by Figs. 1 and 2, letting it spread as much as it will.

With your eye-punch, pin, sow block and fullers in proper shape, you can now get ready to punch the eye. Square the shoulder *B D* on both sides, so they are exactly opposite, then with calipers or dividers set at ⅞-inch radius, and with *E* as center, mark *F* on both sides with center punch.

Place the middle of your eye-punch over this center mark and punch the eye clean. In punching eyes have your helper strike light and quick, rather than heavy blows. These bend the punch and make a crooked hole. Do not put in your eye-pin yet.

With a caliper set at ¾ inch, hook one end in the eye mark for the fuller, as in Fig. 4. Take first a ½-inch, then a ⅝ top and bottom fuller and work it down 1 1-16 inch square. Then turn and work to octagon, using ¾-inch fullers, until it is ⅞-inch octagon in neck, as shown in Fig. 5. Draw out stock for pene about 1⅛ inch round.

Turn around and, holding pene, draw down the other end in a similar manner as shown by sketches and dimensions. Round up stock of pole to 1½ inches diameter and cut off 1⅝ inches long, as shown

in Fig. 8. Then chip off corners *A B C D*, Fig. 6. Take a set hammer and dress the boss up nicely. Set hammer on sow block H. Fig. 7, and put in eye-pin. Put small bottom stand in anvil, and with set hammer work it down to 1 1-16 inch thick, changing your pin from side to side to make it even and keep the eye straight. Then take a last look and see if it is straight and lines up from both sides. Cut off pene, leaving 7/8 inch, and chip corners as shown. Then swage and round pene and leave it in the ashes to cool. When cool have it ground up and then heat to a medium cherry. Set under a stream of

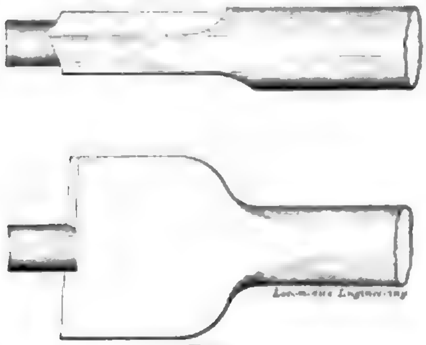


Fig. 1
COUNTERBORE FOR HOG-NOSE DRILL.

water to harden until face is cold, then turn up pene under the stream of water. Take an emery stick and polish face on pene and let it come down to a light straw, cool off, and you will have a hammer that is A1.

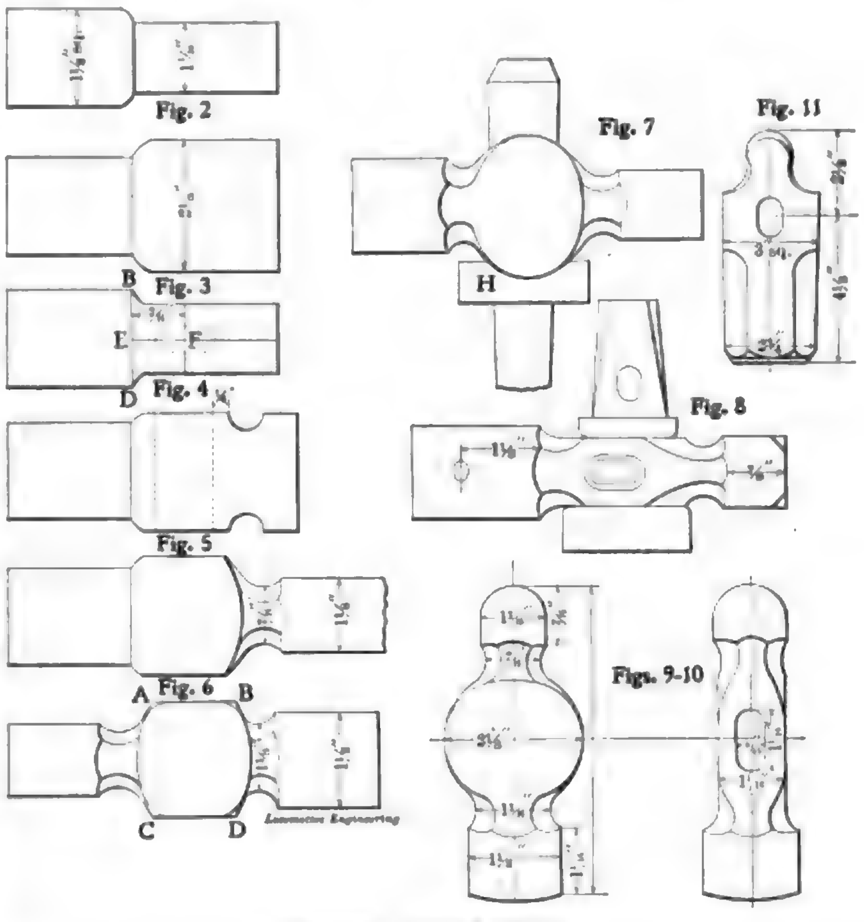
In forging steel never get it too hot, for if it is once heated too hot on a certain spot, it is gone forever. It may not crack at first, but the strain on steel is like the strain on everything else, it always cracks at the weakest point. Uneven heating is the mother of cracks.

In hammering, the even stretching of the mass to the point wanted is the first rudiment in the working of steel, therefore cold hammering is injurious. For example, take a piece of self-hardening steel, and you work it black and then keep pounding away on it; it will soon crack all up. You may say tool steel and mushet are too far different to make a comparison. Take iron or soft steel, and what is the result of hammering them cold? The blows do not start the center, neither do they move the mass evenly at any point. The result is innumerable small fractures.

I am not in favor of limited cold hammering, for the eye is defective, and what may look all right may be all wrong and our hammer breaks the first thing. We would say that was a poor piece of steel.

The principal dimensions of a hand hammer are shown, Figs. 9 and 10. How to use it cannot be described on paper; practice is its only teacher. Fig. 11 shows the principal sizes that make a well-proportioned 1-pound sledge.

The only caution is about the face. It should not be too high in the middle, as it will split the heads of tools.



FORGING A HAND HAMMER.

Hog-Nose Twist Drill.

A recent visit to the Manchester Locomotive Works revealed, among other things, a form of hog-nose drill that is not in common use. Why is it, by the way, that we machinists use about the homeliest names we can find for such tools, anyhow? Why not say "flat-nose" drill, instead of "hog-nose"? and there are other cases where names might be changed to advantage—but probably never will be. But to return to the drill.

Fig. 2
A HOG-NOSE DRILL.

It was being used to drill out the four corners of a solid end rod (this rod had square brasses and adjusting key), and was walking through it in good shape. First, a 3/8-inch drill is put through, then a counterbore with a guide on end, as shown in Fig. 1, starts the hole true and of just the size of the flat-nose drill that is to follow.

The flat-nose is shown in Fig. 2, and differs from the ordinary only in having a spiral or twist groove on one side and a small hole for convenience in milling. The smaller ones didn't have this, though. The end view gives an idea of the section and shape of groove. It cuts a heavy, smooth ship, and clears itself nicely, while it retains the straight drilling property of the usual "hog-nose." The tendency of some drills to run to one side makes this a particularly good one for work that requires a straight hole. The workman who kindly showed it to the writer considered it the best he had ever used.

An expert who has made accidents to steam boilers a special study says: It has never been demonstrated that boiler plate other than that subjected to the action of fire and hot gases has had its properties changed by long continued service.

Our editorial on spectacles for engineers has reached India, for in the August 12th issue of the *Railway Times*, of Bombay, we find the whole thing reproduced, with due credit. Our brother engineers in the distant land evidently appreciate the situation and propose helping the cause.

Turning Solid Cross-Head Pins.

As solid cross-head pins are being used to considerable extent in some localities, it may be interesting to see how they are turned in some shops, and it must be admitted they have some advantages as well as disadvantages, when compared with the loose pin.

There are several methods used in various shops, from the hand machine to the special tools shown in outline here, not forgetting the cross-head lathe attachment which has been patented from time to time and which usually turns the cross-head in about two-thirds of a revolution and back again. This arrangement either uses two tools, one back and one front, or shifts the cross-head so as to complete the turning. This idea was probably the foundation of the machine shown in Fig. 1, and which was found in the Manchester Locomotive Works recently. The sketches shown give an idea as to its method of working, but are, of course, only an outline and not all in correct proportions, but the idea is there.

In this the cross-head is fastened solidly to the machine in a vertical position, so that the center of the cross-head pin is in line with the main shaft, as shown in the top view.

Taking the side view of the machine *A* is the main driving pinion, which drives the gear *B*, also crank *C*, which is fastened to same shaft. This is connected by the rod shown to the segment *G*, which gives motion to gear *H*, shown in both views. This turns gear *H* and carries the frame with it about two-thirds of a revolution, so that the tools in the tool-holder (shown but there may have been difficulties in the way of design which were not apparent at a hasty glance. The tool-holder and method of holding tools are shown, so that little more need be said, the tools being the last fifty years, and though only a sketch is shown the working will be clear.

The top view shows the gears, or rather gear *a b*, for it is one gear with about a third of its face turned down in the center

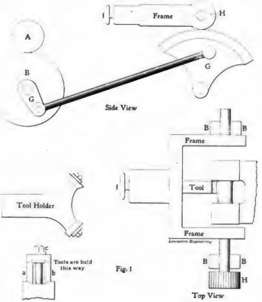


Fig. 1

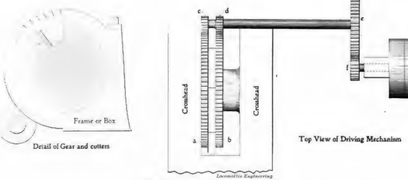


FIG. 2. TURNING SOLID CROSS-HEAD PINS.

in small sketch) cover the entire surface at each complete sweep. The frame is fed along by a ratchet feed, similar to a planer and moves in the bearings, as shown. The gear *H* is wide face to allow for this. It would seem better to feed the cross-head, fed in, of course, by the hand wheel shown at back of frame.

The machine at the Rhode Island Locomotive Works is built on the lines of some of the hand and portable power machines which have been used at various times for for a bearing in the frame or box shown in the detail. This is driven by the double-face pinion *c d*, which in turn derives its motion from the pulleys shown through gear *e* and pinion *f*. This view also shows the cross-head in place.

The detail sketch shows the gear and one of the tools it carries on the left, and the frame or box on the right, with the section lined center part of the gear bearing it. As will be seen, the gear is in halves, so as to be put around the pin and the top half of the box bolted down. One tool is shown let into the gear, and there is another opposite this, making two on each side. There seemed to be no good provision for setting the tool into the work, which seems to be the greatest objection to this type of machine. The cross-head is fed along, and thus the whole pin turned, as the gear and tool revolve continuously till it is done.

SIX-WHEEL AIR LOCOMOTIVE.

A Six Wheel Air Locomotive.

A departure from regular compressed-air locomotive practice by the Baldwin Locomotive Works is shown in the addition of another pair of drivers in the engine for the H. C. Frick Coal Company. This was done on account of light track. It will be noticed that the cylinders are ribbed the same as the new Westinghouse air pump, so as to expose more surface to the air, but with this difference: The pump uses the ribs to radiate more heat and keep the pump cool, while this locomotive uses them to absorb heat from the atmosphere and keep the cylinder warm.

As will be seen, the engine is compound, having cylinders 5¾ and 9 inches by 12 inches stroke. The gage is 2 feet 11 inches; drivers, 26 inches in diameter, and total wheel-base of 5 feet 2 inches. The air tanks are both 35 inches in diameter, one being 15 feet long and the other 17 feet 6 inches. The total weight is 28,790 pounds.

There has lately been installed on the cars of the Louvre-Saint Cloud line, Paris, a low-pressure acetylene lighting system, on a novel plan. The vehicles, while built under the form of an omnibus, are really street cars, running as they do on tracks and are also provided with an "imperial" or second story. In this case, however, the material which generates the gas is not ordinary calcium carbide, but is what is called "acétylithe," an article originated by MM. Létang and Serrollet. This substance is calcium carbide treated with glucose after an immersion of several weeks in petroleum, thus preventing an overproduction of gas. The generator is placed on the platform of the car, under the stairs which lead into the imperial, is of a new form, being also simple and effective. After being generated, the gas is dried, and the impurities are removed. Lead pipes conduct the gas to the burners, which are inclosed in globes somewhat similar to those used for the well-known Pintsch light. There are two in the car proper; one on the imperial and one on the platform, as well as a small signal light of 5 candle-power. The total expense for the five lights is stated to be about four cents per hour, which is much cheaper than an equivalent amount of electric light.

Caskey Portable Hydro-Pneumatic Riveter.

The engraving shows a sectional view of a new style portable riveter manufactured by Pedrick & Ayer Company, Philadelphia, Pa., especially adapted for shipyards and structural iron work, and the use of boiler-makers and bridge-builders.

The Caskey portable hydro-pneumatic riveter is designed for using compressed air as a prime mover, with the hydrocarbon fluid used in the oil chambers and oil cylinders.

This admits of the machine being operated in very cold weather and in open places, with no liability of freezing and causing trouble, as is the case with riveters of hydraulic construction, and is an important feature.

The engraving is largely self-explanatory. The main frame No. 68 is a steel casting, and can be made in any desired

shape, adapted to the conditions and positions in which the riveter is to work. The oil chamber and pressure cylinder No. 41 is made from nickel steel forging and accurately machined. The dolly bar or hydraulic piston No. 13 is manufactured of the best tool steel, accurately machined, hardened and ground. No. 42 inside cylinder head is of cast steel. There are but four moving parts, and the operating lever No. 15 is the only moving part exposed. All packings are easy of examination.

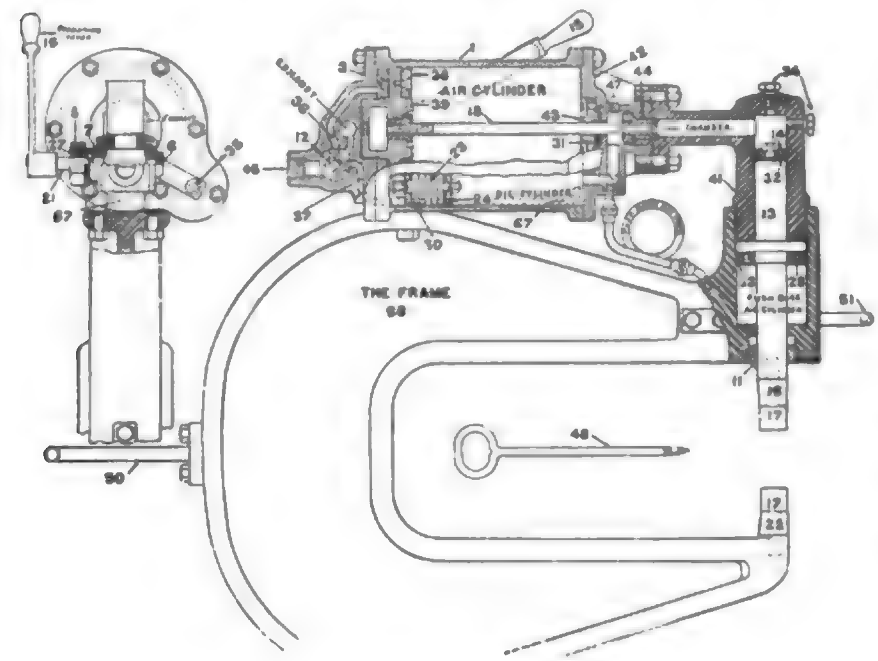
The construction of the machine secures the maximum pressure on a rivet with as little weight in the machine as is possible. It works rapidly, without shock or jar, is easy to handle and gives a uniform pressure on every rivet. No blow is given when using this machine, and therefore no crystallization takes place upon the rivet when being driven. The riveter is suspended by a bail, which allows it to be moved and operated in either a vertical or horizontal position; by changing the bail it can be used sideways with equal facility. Suitable handles are provided on front and back for the convenience of the operator in placing it over the work.

The operating lever is so constructed and connected that the operator can control all movements of the riveter, whether standing at the side, back or front of the machine.

No adjustment of the length of the dolly bar or the rivet dies No. 17 is required when riveting on various thicknesses of metal.

The dolly bar has a movement of 4½ inches. The first 2¼ inches is known as the rapid movement, which is set down direct by the pressure from the receiver tank of 80 pounds. The last 2¼ inches is called the effective movement, and develops the maximum pressure, giving a uniform squeeze throughout the entire stroke of the last 2¼ inches, which causes the hot rivet in the hole to be very nicely upset, filling the hole solid. This pressure is exerted on the dolly bar through the hydro-carbon fluid, which is non-freezing, and so long as the operating valve is open, admitting compressed air to the main piston, the maximum squeeze is maintained on the rivet. After a rivet is headed, the dolly bar and the die are positively moved back from it by a quick movement of the operating lever.

This riveter is built in twenty-one different styles and sizes, for driving rivets from ⅜ to 1¼ inches. All machines are proportioned for using compressed air at 80 pounds per square inch, and to exert whatever pressure on rivets is required. Messrs. Manning, Maxwell & Moore, 85, 87, 89 Liberty street, New York city, are the sole sales agents, and will send descriptive catalogues and further information upon application.



CASKEY PORTABLE RIVETER.

A remarkable coincidence in weight in the pressed-steel cars has been observed. Twenty-five 100,000-pound cars of this type on three different roads weigh just exactly 36,000 pounds each. This uniformity of weight is due to the exact dimensions, and it cannot be secured in wooden construction, as no two pieces of wood will weigh the same in accordance with their dimensions. It is said that never before the steel car was constructed could twenty-five cars be found in one day or one week which were equal in weight.—*Pittsburgh Post.*

New York Central Earnings and Expenses.

The following notes are taken from the last annual report of the New York Central:

Freight earnings were, in amount, practically the same as last year, the increase being $33,834.40, less than one-eighth of one per cent. The tonnage, however, increased 1,953,035 tons, or 8½ per cent.; and the tonnage carried one mile was 158,895,713 tons greater, or 3½ per cent.

The rate per ton per mile decreased from 6.1 to 5.9 mills. The freight earnings per train-mile were $1.90 as compared with $1.83 in 1897-98, a gain of 3.8 per cent.

As in the previous year, excellent results were obtained in business local to the company's system, this class of traffic showing substantial gain. The tonnage increase was 2,341,161 tons, or 12 per cent., much more than offsetting the decrease in through traffic caused by the falling off in grain shipments, the delay (owing to the severity of the winter season) in the resumption of lake navigation, and the Buffalo labor troubles.

West-bound through tonnage from New York city showed increases of 12 per cent.; and the results on the various leased lines, both as to tonnage and earnings, were better than those of the preceding year.

Passenger earnings increased $472,314.43, or 3.6 per cent. This increase was generally distributed among the company's lines, and covered all classes of business; 501,648 more passengers were carried than in the year preceding, a gain of 2.1 per cent. The earnings per mile of road increased from $5,532.97 to $5,730.19 or $197.22.

The decrease of $382,032.63 in the year's expenses does not fully represent the extent of the economy in operation and maintenance. Notwithstanding the increases in the volume of business handled, the expense of conducting transportation decreased $448,155.05.

The introduction of twenty-eight new mogul locomotives, each capable of hauling eighty loaded 30-ton grain cars (making a gross weight of 3,600 tons for the train and its load), has resulted in a saving of 505,114 train-miles, or 3½ per cent. decrease, although the volume of freight traffic was 8½ per cent. greater. Twenty additional locomotives of the same type were ordered toward the close of the year.

The average train load for the entire system, including freight, was 346 tons, as against 320 tons in 1897-98. The average is, of course, much reduced by the large proportion of the mileage of branch and leased lines on which the train load is necessarily small. On the New York Central main line the average train load of through freight, east and west, was 750 tons.

The increase in engine mileage was 372,303 miles, being less than 1 per cent. and little more than one-tenth of the increase of 1898 over 1897.

WESTINGHOUSE AIR-BRAKE COMPANY'S EXPERTS.

The Empire State Express was delayed one day recently, and in the successful endeavor to "get there" on time, the engineer made the splendid run of the 150 miles between Syracuse and Buffalo in 140 minutes. What this really means is best realized by engineers who handle fast trains daily.

The Swiss Plant for Building Railway Machinery.

On August 20th the editor of Locomotive Engineering received a cablegram from Mr. Camille Barbey, Yverdon, Switzerland, asking that four pages should be reserved in the September issue of Locomotive Engineering for an advertisement that was on the way. Mr. Barbey is a well-known writer on engineering subjects and manager of a railway in Switzerland. The copy for the advertisement did not arrive in New York till September 2d, so it was too late for publication in that month's issue. The advertisement intimated that large works were to be built at Yverdon, Switzerland, by a syndicate of American and European capitalists for the manufacture of railway machinery. Mr. Barbey announced that the Baldwin Locomotive Works and the Brill Works, of Philadelphia, were behind the enterprise.

Particulars about the enterprise got into the hands of the Associated Press and were published. The Baldwin Locomotive Works promptly denied that they were in any way connected with the business, and their example was quickly followed by the Brill Company. We at once communicated with Mr. Barbey, and have received a cablegram from him requesting that the advertisements should not be published till further notice.

We believe that the enterprise is bona fide, but that there have been some misunderstandings about the American connection. Meantime we are waiting for new developments.

A parliamentary commission in England has been for some time investigating the subject of "safety appliances for railroad trains." Safety appliances as used in America have been discussed at great length by witnesses, much conflict of opinion being expressed regarding the accident preventing properties of automatic couplers. Persons familiar with the condition of American rolling stock as found in different districts would be amused to read the following statement made by one witness: "In New England the railways, being rich, were equipped and organized, and that they served a population which, being more or less English in origin, had respect for human life; whereas in the negro States the conditions were just the reverse of these."

The International Correspondence School instruction car No. 101 was located at the Chesapeake & Ohio local depot, at Fourth street, and was visited by the members and guests in large numbers during the meeting. It was in charge of Messrs. Erwin and Dailey. Superintendent W. N. Mitchell, of the railway department of the school, was in attendance at all the sessions of the Traveling Engineers' convention.

Another Type of Boycott.

Now that the Kansas City, Pittsburgh & Gulf Railroad have got their seaport at Port Arthur completed, and grain and other products for foreign use can find a short route to the Gulf, and thence all over the world by sea, they are beset by a boycott from competing roads which want to haul these products by another route eastward to the sea.

Just how this fight between the corporations will turn out cannot be seen at the present writing. Very likely it will end in a truce which might be called an armed neutrality, in which the weapons will be tariffs and injunctions, and the boycott will take on a high-toned appearance.

There is a miserable rate war prevailing between the Burlington and the Kansas City, Fort Scott & Memphis for business between certain Southwestern cities. The trouble was begun by the Burlington cutting rates, an action promptly followed by its rival. Cut followed cut until now the roads are doing the business practically for nothing. That kind of business has a bad moral effect. The Burlington is actually carrying freight from Omaha to St. Louis, a distance of over 450 miles, for 3 cents a hundred pounds, and paying bridge tolls. When rates are restored the granger statesman will naturally try to compel the railroad companies by law to carry freight all the time at the rates they voluntarily inaugurated for competitive purposes.

The Lackawanna road, as the Delaware, Lackawanna & Western is now being called, made a fast run from New York to Buffalo on September 17th, with a newspaper train, consisting of three baggage cars. The distance, 410 miles, was made in 7 hours and 23 minutes. Considering the mountainous regions through which this road runs, this is remarkably fast time.

Mr. Wm. C. Baker, 143 Liberty street, New York, has issued a new catalogue, which should be of great assistance to those having car-heating in charge. The various types of Baker heaters are shown, and their construction made plain; while a list of parts and illustrations of them make it easy to order duplicate parts. Now that winter is once more on its way, we advise sending for one of these catalogues.

The annual report of the New York Central says that the cost of engine repairs per locomotive mile run was 3.47 cents. The cost of freight-car repairs, including $908,550.35 of extraordinary items, was 14.15 cents per train-mile. The cost of passenger-car repairs per train-mile run was 5.01 cents. The total mileage owned and controlled by this company is now 6,744 miles.

A Senseless Traveler.

A fussy gentleman of a type of traveler well known in England was about to go from Kings Cross, London, to Manchester. As usual in such cases, he gave his luggage to a porter and told him to take it to the Manchester train. The traveler then went around the corner to see a man, and the interview lasted close upon starting time. On reaching the platform the traveler found a train ready to start, and he jumped into the nearest car, stretching himself half out of the window to look for the porter who had taken away his baggage. As the train moved out he saw the porter on the other side of the platform with the baggage beside him. The traveler shook his fist at the porter and shouted a storm of abuse.

"Fool, yourself," replied the porter. "Your baggage has more sense than you have, for it is here safe enough, looking at you going away on the wrong train."

The names of a number of the dining cars on the Baltimore & Ohio Railroad are to be changed. Hitherto, with several exceptions, however, Roman generals were complimented, but the management has decided to give some free advertising to the prominent hotels along the line. When all the changes are made, the thirteen diners will be known as follows: Waldorf, Astoria, Savoy, Netherlands, Manhattan, Imperial, Raleigh, Walton, Holland, Carrollton, Brunswick, Massasoit and Brevoort.

We predict that our new valve-motion model will be the most popular thing ever got out for the aid and instruction of people studying valve motion. It will make an admirable Christmas present, and will prove an attractive ornament for a parlor table. The low price of $10 puts it within the reach of nearly all enginemen and mechanics.

The officials of the Chesapeake & Ohio Railway claim that their freight locomotives pull more tons per train than the motive power of any other railroad. This is rather strange, for the road is quite hilly in many parts. The officials have been devoting much attention to having the cars loaded to their full capacity where possible.

"Making Records" is the name of an illustrated pamphlet recently issued by the Joseph Dixon Crucible Company, of Jersey City, N. J. It sets forth in unmistakable terms the advantage of using graphite to keep the rubbing surfaces lubricated.

A prominent superintendent of motive power, speaking at the last convention of the Traveling Engineers' Association, said that the science of modern railroading was to achieve success in putting the blame upon the other fellow.

Exhibits at Traveling Engineers' Convention.

At the Traveling Engineers' convention there were a number of exhibits of locomotive appliances, but not as many as usual.

The Nathan Manufacturing Company had their latest type of triple-feed cup, and samples of their steam chest choke plug which has been in use for some time. This company are making the steam passages and pipes in their cups larger than formerly, with a view to give a better circulation from the cup to the steam chest. The choke plugs are much larger also, but the steam supply will give a regular feed. They also had a reversible boiler check, which could be used on either side of the boiler.

The Detroit Lubricator Company had one of their triple cups with Tippett attachment, and one without it with enlarged steam openings and a choke at the steam-chest plug, which is made variable with a check valve.

A Lackawanna cup of the latest design was on exhibition; there are a number of new features in it.

In the injector line there were the Sellers Class N, improved; the Metropolitan, and the Hancock double inspirator, two separate machines in one casting.

The Crosby Steam Gage & Valve Company had one of their latest air-brake recording gages with an aluminum case, the gearing arranged for a speed of card to make a revolution in six hours or twelve hours. They also had a line of steam gages, muffled safety valves, globe valves and an automatic whistle valve, with the steam valve so balanced that it pulls easier than the old type.

The Star Brass Company showed a muffled pop valve and an air-brake inspector's gage.

All of these exhibits had sectional models. The Cook Cooler Company had on exhibition their series of colored charts showing the various stages of hot journals and bearings.

The most extensive exhibit was one of the magnesia boiler coverings of the Keasbey & Mattison Company, nearly every variety of covering for pipes and boilers being shown.

The Ajax Metal Company, of Philadelphia, wish us to deny as emphatically as we can the report that they had joined the Brass Trust. Mr. J. G. Hendrickson, the president of the Ajax Metal Company, is wrathful over the persistent way that some of the Brass Trust friends represent him as a member of the combine. It was a fizzle of the smallest kind.

We have received from England an application for a good car-shop foreman. The right man would be liberally treated and have a permanent position.

Unfair Treatment of American Products

In the course of a private letter a friend in England writes:

"There is unfair work on the Midland. The Baldwin engines were made to work at 180 pounds, but the Midland have reduced them to 160 pounds. Why? They are having a private trial; a Baldwin engine, 18 x 24, 5 feet, 160 pounds, and a Midland engine, 18 x 26, 5 feet, 160 pounds. Of course, those 2 inches in the stroke are of vast importance, and give the Midland engine a great advantage. You will remember the Midland Company had Pullman cars, and proved (?) they were not as good as English carriages. Then the Midland had Westinghouse brake, and proved (?) that it was not as good as the English vacuum. Now, the Midland has American engines, and are proving (?) that they are not as good as the English engines. Cars, brakes and engines, one after the other; it is too clear; one can see that American appliances in England do not have fair treatment. If you ask either the Pullman, Westinghouse or Baldwin companies, no doubt they will agree that this is true."

On August 19th engine No. 948, one of the new passenger ten-wheelers, belonging to the New York Central, similar to what was illustrated in our August number, pulled sixteen cars, including nine Wagners, from New York to Albany, 144 miles, in 3 hours and 15 minutes. The train was 1,212 feet long, and the weight, including engine, was 916 tons. The average speed was 44 miles an hour. For such a weight of train, we think this breaks the record.

In connection with the Baldwin Locomotives now running on the Midland Railway of England, the chairman of the Board of Directors mentioned what will strike American readers as a curious custom. He said that when a new locomotive had run about 1,000 miles it was taken apart and thoroughly examined for defects. Our people assume that when an engine has run 1,000 miles without mishap there are no defects to look for.

A recent visit to the United States Metallic Packing Company, in Philadelphia, found them extremely busy and about to occupy additional space. Their order numbers are now 'way up over the 99,000 mark, which, added to the product of their English branch, brings it well up towards a total of 120,000 sets of packing.

The Falls Hollow Staybolt Company, Cuyahoga Falls, Ohio, report that they are doing a good business with leading railroad companies and builders of locomotives and marine boilers. Many purchasers of boilers are specifying Falls Hollow staybolts.

Consult With the Fireman.

President McBain, of the Traveling Engineers' Association, said in his address that we should ask the firemen about the condition of the engines, that they could give useful information and hints for the betterment of the service.

This is timely advice. The fireman can give a better idea of the condition of the firebox and the way the engine steams than anyone else, and asking his advice on these matters will draw his attention to an explanation of the causes of good results or of poor ones.

Cleaning Old Waste.

At the West Philadelphia shops of the Pennsylvania Railroad they are now boiling out old waste for use in rough wiping of engines. Some of this comes from driving box cellars, and this is squeezed first in an air press, then it is all boiled in a tank with soda in the water for about an hour.

The drying rack consists of shelves of coarse iron netting with sheet iron front. These fit in a boxed-in hot air chamber. The air being forced over steam pipes by a blower and passing around the shelves soon dries it out. They have found that cellars have been packed too tight, and by removing a portion of it the bearings run better. We believe that this is many times the cause of apparently mysterious heating.

We frequently hear about discomforts and annoyances incident to sleeping-car travel, but some painful discomforts have never been described. Lately the writer had taken off his shoes and stockings, and was sitting behind the curtain undoing certain garments, but keeping his feet as close to the edge of the aisle as possible. But in spite of that, a man comes along and plants a No. 10 brogan square on top of one of the bare feet. The relief of swearing aloud cannot be enjoyed in a sleeping car, but amidst the groans of pain might have been heard muttered words that are not taught in Sunday schools.

A feature of the National Export Exposition at Philadelphia is an exhibit by the International Correspondence Schools, Scranton, Pa., illustrating their method of teaching by mail. The bound volumes of their instruction and question papers, as well as work done by students, including numerous drawing plates, may be inspected by visitors, and a representative is in charge to give full particulars.

We have received from the Buffalo Forge Company copies of several letters sent them by leading manufacturing establishments, commending the efficiency of their apparatus for heating devices.

AMERICAN LOCOMOTIVE SANDER COMPANY,

N. E. CORNER THIRTEENTH AND WILLOW STS.,

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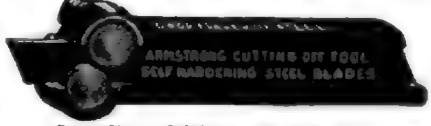

Seven Sizes. Self-hardening Steel Blades.
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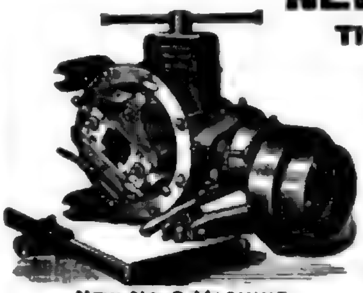

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Adjustable Stocks and Dies, and other tools.

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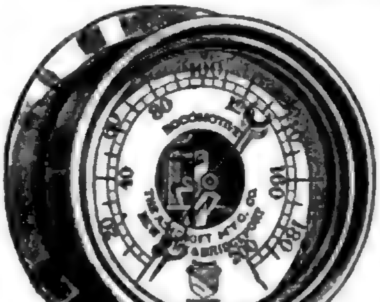

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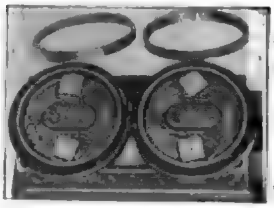

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ABSOLUTELY STEAM-TIGHT ALL THE TIME.
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SEND FOR CATALOGUE AND 500 TESTIMONIALS.
MENTION LOCOMOTIVE ENGINEERING.

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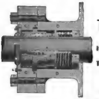

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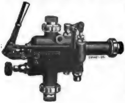

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Quality Unsurpassed.

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PURITY, DUCTILITY AND SOFTNESS.

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to establish a branch agency in New York for a new meritorious product, manufactured under patented process in France and Mexico, indorsed and adopted by four foreign national governments and 28 railway companies abroad. United States arsenal tests and reports now ready for publication, with many authoritative testimonials. The product has an enormous demand, with absolutely no competition, and will be shipped on trial to any interested, responsible party. Applicant is expected to furnish the very best of references, and to such exceptional inducements, with credit, will be granted. An independent income for a competent business man. Wire us your intentions and secure your territory at once.

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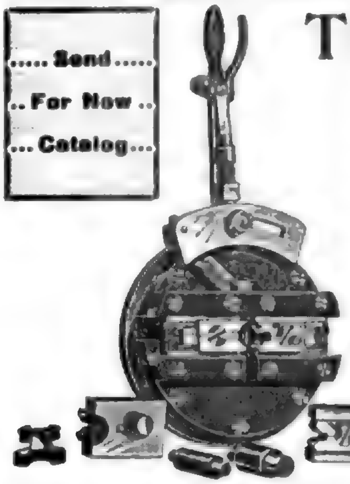

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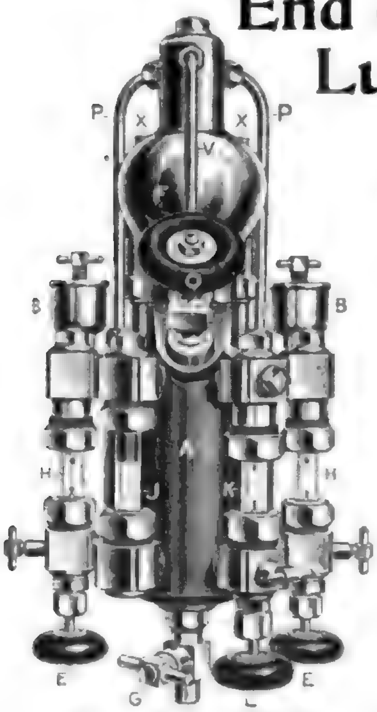

By placing glass fittings above the steam chests, so that they will form part of the tallow pipes, the operations going on within the tallow pipes can be observed. In this way it has been demonstrated on several of the leading trunk lines, and can be proved anywhere, that the Detroit Lubricators with Tippett Attachment deliver the oil regularly to the wearing parts, no matter how great the back pressure. In addition to this visible proof, the ease with which the engine works and the low fuel record it can make are evidence of perfect lubrication. Blueprint of our triple lubricator, with Tippett Attachment, and descriptive matter will be sent on application.

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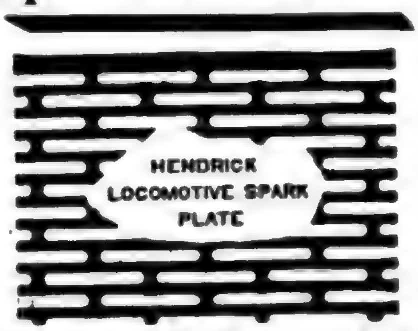

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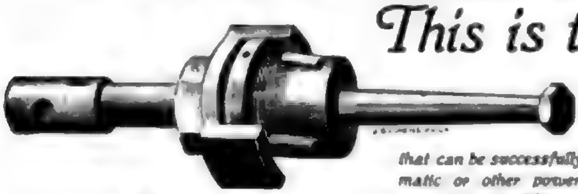

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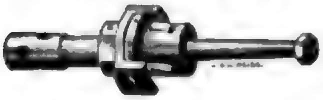

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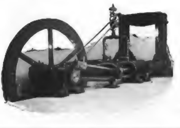

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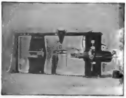

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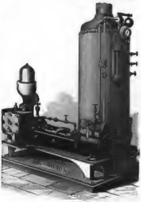

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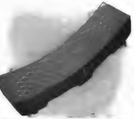

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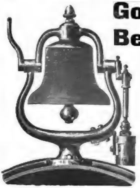

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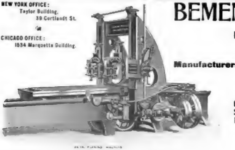

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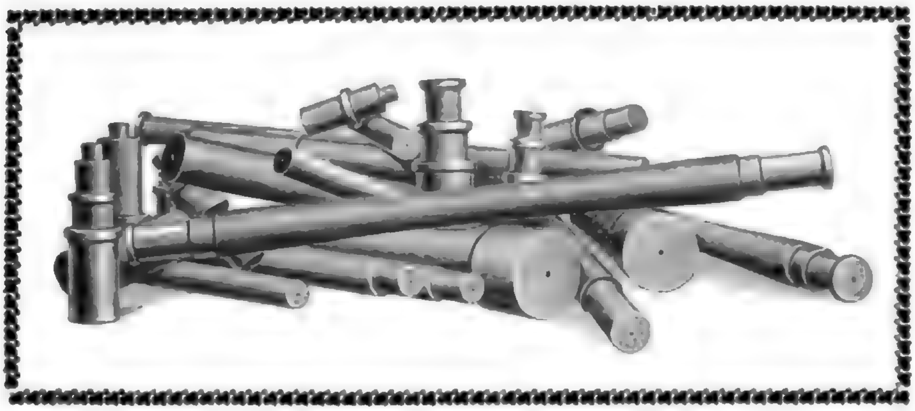

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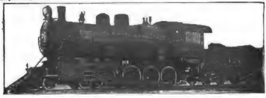

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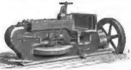

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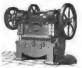

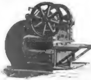

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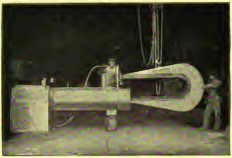

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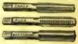

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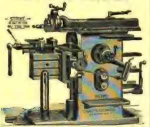

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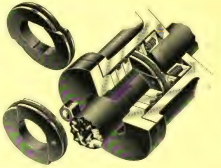

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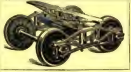

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Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XII 95 Liberty Street, New York, November, 1899 No. 11

The Hundredth Locomotive.

The interesting picture on page 473 shows a ceremony unknown in this country, namely, blessing a locomotive. This is the hundredth engine turned out by the Sormovo Works at Nijni Novgorod, and, as will be seen in the separate picture of the engine on this page, it is a good specimen of this type of an engine. Our friend, W. F. Dixon, chief engineer of the works, can also be seen on the engine.

THE HUNDREDTH ENGINE BUILT AT SORMOVO, RUSSIA.

Everything is done by rule in Russia, and the ceremony shows the solemn proceedings made necessary by the completion of the hundredth locomotive. It also occurred at the first, so as to be sure and start them off right.

The church whose spire is just visible over the shop building, is, we understand, in the grounds of the company, so that the officiating clergy do not have far to come. The chief priest is seen in the center of the picture, on the altar erected for the purpose, while the twelve deacons, six on each side, support the banners of the church very prominently.

In spite of the solemnity of the occasion, from their point of view, it will be seen that some of the people in the foreground were exceedingly interested in being "took," and evidently determined to show their faces rather than the backs of their heads.

Adventures of an Engineer in Tropical America.

BY W. D. HOLLAND.

FOURTH LETTER.

I imparted my favorable impressions of this life of rural bliss to Mr. Roberts, and he did not seem at all surprised, feeling himself inclined to settle there; yet he told me such a thing was not to be thought of for the present, as my contract was binding for at least six months. However, he consented to remain a day or two longer, to cure me of my fancy, as he said. He felt positive that, in time, I should again yearn for the land where the girls wore bloomers and walked on solid ground —for Hielo was a Central American Venice, and the inhabitants spent more time in the water than out of it; their national costume adapting them admirably for both aquatic and land exercise without the inconvenience of changing.

While awaiting dinner at the Alcalde's, I will make you acquainted with my friend Martin Roberts, who, under the administration of President Barillas, was the Mark Hanna of Central America, not a contract nor a position being given without his sanction.

The canal on which I was appointed as chief engineer was to connect the Montagua river with the Bay of Graciosa, and the work presented more difficulties than the Panama Canal. Mr. Roberts and his friends, Hackmeyer & Co., had been given the contract to dig a ditch seven miles long for ocean steamers, and to dredge the Montagua river out for over eighty miles. Of course, this task was never intended to be accomplished, as the money was already divided up; and if Barillas had remained president, it would probably never have been started. Unluckily for Roberts and Hackmeyer, however, Barillas was dethroned by Reina Barrios, who pushed the work with all his might and appointed to Mr. Roberts a certain time for its completion, otherwise he theatened to throw him into jail—where, it is needless to say, Roberts went six months later.

Our host now announced to us that the feast was spread, and led us into his "palace," a long hut of bamboo, surrounded by waving cocoanut palms. The usual domestic companions, the parrot and the monkey, saluted us at our entrance, and we found the whole aristocracy of Hielo assembled under the hospitable roof. The ladies, dressed this time in something more substantial than smiles in honor of the occasion, wore gay-colored calico garments with long trains, and had heightened the brilliancy of their coffee-colored complexions by liberally covering their faces with good old wheat flour. The men were airily attired in suits of mosquito

netting, and the meshes were none too close either.

On sitting down I at once noticed the entire absence of knives and forks, and was informed by Mr. Roberts that their use was unknown. With us, however, poor slaves of civilization as we were, their want was keenly felt, and Mr. Roberts sent some negroes to the boats for them, also ordering a few bottles of wine for the ladies. The menu consisted of fried parrots, breadfruit, mangoes and cocoanuts, coffee, chocolate, and last, but not least, of an immense roasted monkey, quite juicy and tender. I must confess that this first banquet among the savages made me homesick for civilization more than anything else. I admit that I might have been spoilt at the Palace Hotel or the Palmer House, but I decidedly disliked the way the ladies used their fingers in place of knives and forks.

After dinner "guerra" was served ("guerra" means "war," a very appropriate name for the native whisky, for after a couple of drinks its effects placed me in a sort of a trance for several days).

The following evening we bade our host and the beautiful town of Hielo a cordial farewell and started for another three days' trip on the river, promising, as we left, to return and settle as soon as our contract expired. But to myself I thought, "Nit."

Our trip was pleasant and gave me another opportunity to enjoy the charms of tropical vegetation. The evenings being cool and moonlit, our Carib niggers preferred to row at night and to rest during the day; thus in the morning we tied our boat up alongside the river banks and started out again at dusk.

On reaching the mouth of the Graciosa Canal we met several small boats, the first sign of human settlers, and soon we found ourselves at the dredge, where I was shown comfortable quarters for the night.

The following morning I started to work. Most of the employés were natives, with only a few Englishmen and one American, so I found it pretty lonesome, as it was the first time I was thus isolated, away from all civilization. Once a month we would send boats for mail and provisions, and by degrees I became used to the solitude, and, when at leisure, would go out into the woods and shoot wild birds and game or spend the evening with Mr. Roberts, playing chess until bedtime. Thus, for five months, the time passed away nicely. Occasionally a commission from Guatemala City came to see how the work was progressing, for Reina Barrios was ever anxious to see the canal finished. Whenever these gentlemen appeared, Mr. Roberts endeavored to have all kinds of delicacies in store for them, especially in the line of liquids, so as to effect favorable reports at headquarters. In fact, most of the commissioners were "under the influence" during the whole length of their stay, and Mr. Roberts saw himself obliged to make out the report himself, after which the worthies departed in high glee. But all things come to a close, especially crooked ones, and with our dilapidated machinery it was as much of an impossibility to complete the work in six months as it would be to dig a canal from Denver to Salt Lake in the same time.

But Roberts was a genius, and he set all his hopes on the rainy season. If there would be enough rain to flood the country, we might manage to set the dredge afloat, and by throwing lines ahead to haul her into the Montagua river. Then, after the return of the dry season, the commissioners would find the dredge in the river, and it would be easy to convince them that the canal filled up again. This scheme was very nicely planned; but our expectations were thwarted, as the rain failed to come, and with some awe we looked forward to the arrival of the commissioners. We succeeded in getting them all intoxicated except one, whom nothing did seem to affect; on the contrary, the more champagne he drank, the more sober he would appear, and he busily wrote in his notebook. I whispered to Roberts that our game was up, unless he could secretly administer poison to this man, and he sadly admitted I was right. The following day a letter announcing the President's approach added to our trouble, and Roberts in despair started for the coast to order more wines and provisions, leaving me behind as commander, with instructions to paint everything in sight with the national colors and to work day and night to prepare an appropriate reception for the ruler of the land. For about two weeks I exerted all my strength, but at the end of this time our provisions gave out, and I hurriedly dispatched a messenger to the coast with orders to purchase food. After ten days he returned with the unwelcome news that the government had declared the canal a fraud, and that Roberts was in irons on his way to Guatemala City.

When I announced this to my half-starved men their fury knew no bounds. Besides, the company was two months in arrears with the pay, and most of them being rebels and revolutionists, they threatened to burn and destroy everything in sight. With great difficulty I persuaded them to a more reasonable proceeding. I advised them to haul all the small boats overland to the Montagua (a distance of two miles) and to make sail up the river for Gualan, the seat of a branch house of Hackmeyer & Co., where there would be a possibility of settling our affairs. My proposal was accepted and carried into execution, though it was a tiresome task. Midnight saw me and my sixty men all safely seated in six boats and ready to start. Mine was the flagship, and took the lead with green signals on port and starboard, while the others carried white lights. We had but few provisions, but the men resolved to help themselves to whatever came across them at the first village we should strike. This was Tenedores, a hamlet about thirty-five miles from the point we started, and we sighted it at about 8 o'clock the next morning. I told my troubles to the Alcalde, but he pretended to be unable to help us; so I gave orders to capture all the pigs and chickens in town, which was done with great readiness on the part of my rebels, and with a booty of ten pigs and about fifty chickens, we again took to our boats. Our next stop was at a banana plantation, where we had a delightful barbecue and chicken dinner, and everybody relished it with great "gusto." After a few days the same performance was repeated at La Libertad, and when the Alcalde called on his soldiers for protection, we scared the whole population out of their wits by inserting a fuse and a stick of dynamite into a pig and turning it loose. Naturally, the unfortunate animal was blown to pieces, and the natives were more alarmed than by an earthquake. My rebels now had free reign, and liberally helped themselves to everything that came handy. When they returned to the boats we found ourselves abundantly supplied with dainties of all sorts, which made further invasions unnecessary. I was glad of this; for once at large, it was hard to get those savages back into the boats again, and I found it safer to select small islands for taking a rest now and then. At the end of three days the water became shallow, and we were obliged to tie up our boats and to continue our journey by land, a trip of forty miles over mountains and streams, through jungles and swamps; and after walking eighteen miles one day and fifteen the next, I was fairly worn out. The soles of my big leather boots were gone, and I called my gang together and had all their shoes brought up to me, selecting a pair that fitted me—for a native can walk barefooted on glass, while I could not. Yet my feet were swollen and very painful; so I was glad to meet a traveling Indian, who good-naturedly lent me his mule and joined us on our trip. I crossed a stream on my mule, and nobody can describe the sensation of this experiment unless he has tried it himself. The mule almost disappeared in the water under my weight, and only the long ears appeared above the surface.

At last we reached Gualan, a town of some 5,000 inhabitants (not counting the fleas), and I was heartily glad once more to strike a place that looked like civilization. My first visit was to Hackmeyer & Co., where I related the treatment we experienced under Roberts and demanded immediate payment of our salaries, which by this time amounted to about $5,000 altogether. Mr. Hackmeyer told me I had broken my contract by leaving the dredges,

BLESSING THE HUNDREDTH ENGINE BUILT AT SORMOVO, RUSSIA.

but I insisted upon being paid at once, otherwise I would telegraph to the American consul, as we were all American and British citizens. Intimidated, he promised to pay me, but decidedly refused to consider the demands of my men, who, upon being informed of the company's intentions, immediately began to dynamite the town. The commandante called on me and asked me to stop the disturbance, but I professed my incapability of doing so as long as the government did not satisfy the claims of my fellow workers. A telegram to the President and to the head firm resulted in my being handed $500, which I divided up among the men, with the promise that they would receive the balance later on. This happened on Christmas Eve, 1893, and I returned to my room, weary, footsore and blue, and the music at the house of my Spanish host reminded me of Christmas Eve a year ago, when I was president of the Occidental Club in Chicago and leader of the german, while now I was leading a band of rebels in the wilderness of Central America, wondering if the town of Gualan would be mine in the morning.

Welcoming Admiral Dewey.

Every reader knows of the red-hot reception Admiral Dewey got in New York on September 29th and 30th; and we need say nothing on that score, except that the city was decorated more profusely and with more beauty than we have ever before seen it.

The railroads were not behindhand, either, as will be seen from the engravings, and we regret not being able to show them all.

The Pennsylvania's new sign-board over the train shed, where the name of the railroad will shortly appear, was neatly used as a "Welcome to Admiral Dewey," as will be seen. These words were outlined with incandescent lamps and made a beautiful night sign. The medallions over the ferry slips and the festoons of flags and bunting added to the effect and made a very attractive display.

Although the Lackawanna Railroad was handicapped and did not have the same opportunity for display, the spirit was there, as can be seen from the smaller picture. This was also very attractive at night, as the lettering stood out in bold relief.

The Jersey Central and the Erie decorated in a less lavish manner, but all had something to show. Up at Weehawken the West Shore had a very creditable display of bunting and streamers, and the famous words, "Gridley, you may fire when ready," surmounted the station. These were also illuminated. We intended showing these, but owing to the cussedness which occasionally gets into a camera as well as a man, the machine went back on us, and we are minus this illustration.

At the Export Exposition.

When one thinks of such common things as rails, firebox sheets, bolts, and the like, they seem the reverse of artistic, and yet in skillful hands they can be made very attractive. Evidence of this is shown in the exhibits of the Pencoyd Iron Works, which comprise the sections of structural material used in bridges and elevated

DELAWARE & LACKAWANNA WELCOME.

PENNSYLVANIA'S DECORATIONS.

structure, and parts of these are shown. With the outside painted black and the sections white, a very striking contrast is made.

Near them the Crescent Steel Company have a good display of forgings and finished work. There are main rods and side rods, milling cutters, saws, etc.

The Illinois Steel Company show a variety of rails, the Bonzano rail joint and a sheet of firebox steel which at once attracts attention. It is 25 feet long, 10 feet wide and ⅜ inch thick.

The Ashton Valve Company were well represented, as was the Coale muffler, and Keasbey & Mattison have a fine display of boiler and pipe covering.

The H. B. Underwood Company show their portable boring bars and valve-seat planer at work on a cylinder, and our old-time friend, D. S. Pedrick, was on hand to greet visitors.

The Pressed Steel Car Company show a flat car, a 40-ton gondola and a 50-ton coal car, all of which attract attention.

Baldwins show a Chicago & Alton and a Wabash engine, both moguls. The former has four air jets in the front of firebox for prevention of smoke. Richmond exhibits a consolidation for the Chesapeake & Ohio. All three are simple engines.

Prompt Action Prevents Accidents.

Some time ago a brakeman on the Baltimore & Ohio Railroad used his brains and saved a passenger train from running into two derailed cars. The company sent him a check for $50 and posted a bulletin complimenting him for his quickness of thought.

A few days later Engineer John Hagerty was oiling his engine at Connellsville, while waiting for the passengers to alight. He heard another train coming, and believed that it was not under proper control. He sprang into his cab, opened the throttle and started his train. The other engine struck the rear car, but it was not a hard blow, and Hagerty's promptness saved ten or a dozen lives.

The company have ordered a handsome gold watch, suitably inscribed, and a gold chain for Engineer Hagerty as a reward for his devotion to duty and "using his brains" in time of emergency.

Model Modern Dining Cars for the Southern Railway.

The Barney & Smith Car Company have recently built two splendid dining cars for the Southern Railway, photographs of which are shown herewith.

The exterior is in accordance with the Southern Railway standard, the cars being 70 feet long over end sills, 9 feet 8½ inches wide over side sills, and are Pullman standard color. The side windows are 52 inches wide, double sash, with French plate glass.

The interior is something new and original in design, the contours being radically changed from what has been used in car construction. The upper deck is formed by a large dome-shaped ceiling, and the lower deck by two smaller domes, impressive at once of dignity and elegance, having the appearance of a cathedral effect rather than of a railway car. The dining room, overhead, is unbroken by this new (in car design) effect, and gives the car an appearance of being wider and higher than it really is.

On entering the car, the buffet, located at the extreme end of the dining room, has a very attractive and handsome appearance, semi-circular in form and mounted by a dome constructed of art glass.

In place of the ordinary openings in the deck for ventilation and light, the shape of the ceiling is maintained by means of bronze grills over the openings, which give the same result for light and ventilation, and add to the elegance of the dome-shaped deck; back of the grills are sash of art glass of dark green and amber colors, complementing the rich red colors of the ceiling.

The gas lamps are specially adapted to this style of design, the exterior of the globe being cut glass, while the interior has been spattered with opal glass; the peculiar mediation effect thereby is unequalled.

At the end of each table, of which there are ten, is an alcove in the side of the car, made very attractive by octagon-shaped mirrors. The alcove is intended as a receptacle for flowers or, if desired, for dining service purposes.

The room has a seating capacity of twenty-nine persons, and is fitted and equipped for serving meals equal to any first-class hotel. The pantry is fitted with lockers, tables, ice cream freezers, sinks, water and all modern conveniences.

The kitchen is commodious, and every inch of room is utilized; a large cooking range, steam table, refrigerator, provision boxes, etc., are all provided for in this compartment. There are also fruit, wine and linen lockers, and a toilet compartment opposite the bar at the end of the car. The arrangement for storing provisions, etc., in ice boxes is very complete.

It is the most modern equipped and original designed car in existence. There is not a piece of common glass in the cars; the window and door panes are all of the finest French plate.

The cars are equipped with Buhoup's wide vestibules; Gold's double-coil steam heat; Pintsch gas; triple-acting brakes; the railway company's standard six-wheel trucks, with McKee Fuller 38-inch, steel-tired wheels and Sterlingworth brake beams.

Weight of each car is 112,000 pounds, and they will run between Greensboro, N. C., and Montgomery, Ala.

NEW DINING CAR FOR SOUTHERN RAILWAY.

H. H. Vreeland on Capital Combinations

Mr. H. H. Vreeland, president of the Metropolitan Street Railway Company of New York, and better known to surface railroad men through his being president of the New York Railroad Club, rose to his present position from train service on surface railways, and unlike many others who have risen from the ranks, always has displayed a warm interest in the men who still fill those positions. Since he became president of the Metropolitan Railway Company Mr. Vreeland has done a great deal to make life more comfortable for the men under his charge, and to help them in any efforts they make towards the line of self-help.

Three years ago he helped the employees to organize the Metropolitan Street Railway Association, which is a benevolent association, and has been of great service to the men connected with it. They had the third anniversary of the organization last month. There was an immense crowd in attendance, and at the finish of the business proceedings a committee of the employés presented Mr. Vreeland with a handsome loving cup and a set of resolutions, formed and framed, as an expression of the high esteem which the employés of the Metropolitan Street Railway Company have for their president. In the course of the remarks made to the meeting, Mr. Vreeland said:

"At a time like this, when there is so much misleading talk indulged in concerning the evil effects to workingmen of large combinations of property, it is well for us to study our own case and inquire what the effect of combination has been upon us. It is, of course, no part of our duty to here discuss the affairs of any other class than our own. We are railroad men, pure and simple, and we must regard movements and tendencies as they would affect ourselves and our business. Probably in no industry in the world has

consolidation been more active in the last ten years than in railroads. In fact, railroad history of that period is one continuous record of 'combinations,' 'amalgamations,' 'mergings,' 'leasings,' or whatever terms lawyers please to give to one and the same thing. In the nine years since 1890, 946 railroads, aggregating 63,000 miles, have been consolidated.

"None of the eloquent gentlemen whose prerogative it is to interest themselves in everyone else's business, will claim that by reason of this consolidation the number of railroad employés in the United States has been lessened or wages reduced. It is true these consolidations have saved millions of dollars paid to high-class and ornamental officials, but so far as the operating and working forces are concerned (and with this we are most interested), the effect has been good. Within the period named, hours of labor have been lessened and wages increased, and in that time the number of railroad employees has grown, not alone by reason of extended mileage, but because even the so-called labor-saving improvements have called for more human help. I think it is safe to say that in every instance where an improved appliance has displaced one man, the demand for greater safety and improved facilities has created a demand for two.

"Nothing will bring the fact home to your minds more surely than a glance at the past and present of the railroad system on which you are employed. Do you find that the introduction of electricity as a motive power instead of horses has increased or diminished the working forces on the street railways which constitute the Metropolitan system? That system as now consolidated has a wage list ten times as great as that when its constituent properties were operated separately and by horses. Nor is this all, for with every increase in the volume of the list of paid operators, there has been a marked improvement in the personnel and in the standard of the men. No one who knows the truth would, for instance, think of comparing the employés of this system with the rag-tag and bobtail that constituted the working force of its constituent parts or companies when they were separately operated by horse-power. The effect of consolidation upon us has been to elevate out of the slough of what is contemptuously called 'miscellaneous labor' between five and six thousand men into a distinct class, in which not only muscle but brain is demanded."

BUFFET OF SOUTHERN DINING CAR.

Fast Runs on the Pennsylvania Railroad.

Through the courtesy of Mr. Theo. N. Ely, chief of motive power of the Pennsylvania Railroad, we have received the following particulars of fast trains run during the past season. Mr. Ely writes:

"The Class E-1 locomotives have done very satisfactory work on our seashore line this season with fast and heavy trains—among others those scheduled 60 minutes from the Philadelphia side of the Delaware River and 55 minutes from Camden to Atlantic City, or at the rate of 63.6 miles per hour for the distance of 58.3 miles. As five minutes is rather short time in which to make the ferry and get the passengers on the train, the actual running time has frequently been less than that given.

"I enclose a memorandum of some exceptional runs which may be of interest to you. You will note that the numbers of cars and weights of trains are very large for the speeds made."

It seems to us that the speed of 93.5 miles is the highest authentic train speed on record.

Some exceptional runs of regular trains hauled by Class E-1 locomotives from Camden to Atlantic City, distance of 58.3 miles, Pennsylvania Railroad line (W. J. & S. R. R.):

	July 18	July 20	July 31	Sept. 22
Train No.	360	350	360	360
Number of cars	7	8	8	5
Weight of train empty, lbs.	456,100	518,860	526,840	348,050
Number of passengers	317	306	360	152
Running time, min.	51	53	50½	52
Rate of speed for whole distance	68.6	66	69.3	67.2

Portions of above runs that were made at unusually high speeds:

Date.	Between	Distance. Miles.	Time. Minutes.	Miles per Hour. Rate of Speed.
July 18,	Winslow Junct. to Absecon	24.9	13	83
	Winslow Junct. to Drawbridge	30.6	23	79.8
July 20,	Winslow Junct. to Drawbridge	30.6	24	76.5
July 31,	Winslow Junct. to Drawbridge	30.6	22½	81.6
	Winslow Junct. to Absecon	24.9	18	81
Sept. 22,	Berlin to East Hammonton	16.8	14	72
	East Hammonton to Absecon	18.7	12	93.5
	Berlin to Pomona	30.0	21⅝	83.2
	Waterford to Pomona	23.7	16⅝	86
	Hammonton to Pomona	16.2	10⅝	92
	Elwood to Pomona	10.1	6⅝	93

The Toronto *Globe* is responsible for the statement that five locomotives were shipped from New York to England in 1840, and tries to console their English cousins by assuming that it's a "long time between shipments," to paraphrase an old saying. We are inclined to doubt the statement ourselves, as the locomotive business was not very flourishing in the United States at that time and not likely to do much exporting.

Brooks Twelve-Wheeler for Illinois Central.

The enormous twelve-wheel engine herewith shown was recently built by the Brooks Locomotive Works for the Illinois Central Railway Company. The engine has a total weight of 232,200 pounds, of which 193,200 pounds are on the drivers and 39,000 pounds on the truck. The total wheel base of the engine is 26 feet 6 inches, of which 15 feet 9 inches is the driving wheel base. The total wheel base of engine and tender is 55 feet 2¾ inches, and the total length over engine and tender is 65 feet 7⅝ inches. The center of the boiler is 9 feet 8 inches above the rails, and the stack is 15 feet 5 inches above the rails.

The cylinders are 23 x 30 inches, and the driving wheels 57 inches in diameter, with cast steel centers. The journals of the driving main axle are 9½ x 12, and the others 9 x 12. The truck journals are 5½ x 12. The main wheel feed is 10⅛ x 8½ inches. The main crank pin is 7½ x 7. The main coupling pin is 8¼ x 5 and the main pin diameter wheel feed 8⅞ inches. From these figures it will be seen that very liberal bearing and feeding surfaces have been provided.

The length of main rod between centers is 98 inches. The steam ports are 28 inches long by 2½ inches wide, and the exhaust port has an area of 110 square inches. The valves are improved piston, with a maximum travel of 7 inches. The steam lap is 1⅛ inches, lead in full gear 1-16 inch.

The boiler is Player Belpaire wagon top, 82 inches diameter at the front, and carrying a working pressure of 210 pounds.

The firebox is 132 inches long, 42 inches wide and 90 inches deep in front and 81½ inches in back. There are 424 tubes, 2 inches diameter and 14 feet 8⅛ inches long. The firebox provides 263 square feet of heating surface, the tubes 3,237 square feet, the total being 3,500 square feet. The grate area is 37.5.

Jerome packing is used for piston rods, and Westinghouse automatic air brake is used for drivers and tender, with a 9½-inch pump. The drivers have American outside equalized brake, with shoes on back of wheels. Nathan sight feed lubricators are used on the engine and Ashton safety valves. Hancock inspirator is used for feeding purposes, and French springs are used throughout.

If it is to be allowed that all boats from a mudscow to an excursion boat always have the right of way over trains at draw-bridges, the sooner railroads elevate enough to clear, the better. We recently saw an old brick schooner block over a thousand business men nearly half an hour by getting stuck in the draw, and, being one of the men, it didn't strike us as being just the thing.

BROOKS TWELVE-WHEELER FOR THE ILLINOIS CENTRAL RAILROAD.

Plain Talks to the Boys.

GOOD FIRING.

Well, I see that we have a very good-looking audience at this meeting, all classes represented—officials, traveling engineers, locomotive engineers, firemen and all; glad to see you here. What shall we talk about this time?

"How can we learn to fire without making any dense black smoke?" you say.

Now, that is a pretty extensive question to answer in one meeting; some roads work at it for six and eight months before they make much of a showing; so do not expect to hear all about it at this time; we will try and touch the high points.

Firing bituminous coal without making much black smoke is nothing new; it has been done off and on at times for the last forty years, and was done just the same way then that they are trying to do it to-day. Some roads have had it done for years very successfully and kept it to themselves in a manner, and when there was a general change in the motive power office something else generally took all the attention, and in a very short time the black fog began to roll out of all the stacks again.

The trouble was the times were not ripe for it; it was so much more work to do smokeless firing and took so much watching out, both by officials and enginemen, that it would be neglected, and soon everybody would settle down into a Rip Van Winkle sleep over it.

But lately it has been argued over from every point of view; officers, and in many cases the enginemen, have made visits to the roads where it is done regularly, and have seen with their own eyes that it can be done most anywhere if enough pains are taken with firing and working the engine. There is just where it rubs hard enough to make a sore spot—it is a great deal more work to learn how than the old way. Besides, most of us learned how to fire the old style, so it comes natural for us to like it best. We learned how to keep the little engines hot then, and this new way—as they call it—is such a radical departure that we don't see how it can be done on the big engines that are doing the work at present. But it has come to stay, and however unpleasant it is to drop our old customs and habits and take up new ones, yet when we see that a new method is a success we should get to the front.

"But it is not a success," you say. "It is impossible to do it on our road; we have tried it faithfully, and when we had no smoke we had no steam."

Well, now, if I remember, you talked the same way when the oil schedule was first started. The coal business is not half as hard to learn as to run an engine on a short allowance of oil, but you are doing it every day. Seems to me a lot of the boys said that if they paid one-half as much attention to the saving of coal as they were doing for the oil it would save a good many times more money. They have taken you at your own suggestion, and are now putting all their attention on the coal question, and the emission of black smoke is the test of economy.

All reforms hurt someone, a few hurt most everybody; but this reform in firing soft coal will hurt less than any of the many reforms that have been taken up in the last ten years. More men have been disciplined because they could not or did not make good air-brake stops than will get in trouble on account of making too much black smoke. If one man or set of men can do the good work right along every day with a certain engine and train, there is no way of proving that another set of men should not do it also. Better learn how it is done. It is not so much a matter of one shovel firing as a matter of skill in getting each scoop of coal just where it belongs, and not too much in any one place; that takes steady, continuous firing and as light a charge at each time as the working of the engine will justify. Any firing is "one-shovel firing," for you cannot put in but one scoopful at a time; it is the interval between the scoops that counts. Keep the fire even, so it will burn even all over the grate and steady, not black at one time from a heavy fire and thin in spots at another time, as it is when burned out a little more than it should be, which is the condition of a fire on the grate with heavy charges and a wait between firings. Then you will have to admit some air over the fresh coal by holding the door on the latch and using the blower when necessary.

There is one thing dead certain: If you try to burn more coal per hour than the grate surface can take care of you will have lots of smoke and none too much steam; and it is also certain that you can get perfect combustion of a larger amount of coal per hour if fed in continuous and smaller charges than when a heavy fire is put in to "hold her," and wait till it gets going good and put in another heavy load. And do not forget that the way an engineer works an engine means success or failure for the fireman in keeping down the black smoke. If she is pounded hard into a station with a light fire that the smoke is roasted out of and then shut off quick from a full throttle, most any fire will go back on you in starting out, or else take so much coal to hold it on the grates that you will have smoke when pulling out.

The engineer has as much to do with smokeless firing as the fireman; for that reason on many roads the engineer is held responsible for the work.

In all new methods there must be an instructor, and on his tact and ability to show the others much depends. A visit to some of the numerous roads where the plan is in service will help out. This will likely be assigned to the traveling engineer, or make a new place, that of traveling fireman. He should get out on the road and show how this work is to be done. It may have been ten or fifteen years since you have handled a scoop regularly; because you can tell someone else how it should be done do not be too sure that you can do it the first trial; it takes some practice to get into the hang of it. Now, if you were going to show some man how the work is done by handling the scoop yourself, you would not like to pick out the worst engine and train to begin on; you would rather take an engine that was handled so that success would follow the first effort; it is more convincing than when it takes a good many trials on the same engine.

Just remember this point when you expect the enginemen to change their methods, and start in on the easy runs first. Take the light passenger runs; when you get them in line, take the heavier ones, then the freights, and give the men a chance to get to the top by easy stages; it is not fair to take hold of the hardest ones first; let the primary class work come first. Get the valves squared up, packing and valves all tight, flues cleaned, grates evened up so the air spaces are all alike, brick arches put in and boilers cleaned out, then you will be ready for a good start; nothing less is fair either to the men or the company if you expect good results.

Then the officer in charge of the coal distribution can help along considerably. Instead of having five or six different kinds of coal scattered over the system, sometimes all the kinds used on one division, let one kind be assigned to one coaling station, and keep it there while the supply holds out, and if possible have the same kind all along the division. With different kinds of coal on the line for one run of an engine, each of them requiring a different treatment to get the best results, and all the kinds on the same tender, put on at different coal chutes, or at the same chute on different days, the fireman works along with one kind of coal with fair success, so that he feels encouraged, till he gets back into another kind on the tender, and that mixes him up. Now, to give the men a fair show give them the same kind of coal on their division; it is a matter of considerable moment, for the engines can be arranged to steam well on a certain kind of coal, but are all out with another kind, and have to be changed in the front end to do good work. Some varieties of coal need a soft draft, others need a fierce one, and to get steam at all times with all the kinds, the exhaust is made sharp enough to cut the hard kind and wastes the very soft, free-burning coal. This, of course, works dead against smokeless firing, as it calls for a heavy fire at all times.

This is no fancy sketch, Mr. Superintendent; it is a very uncomfortable fact to all concerned, and it is in your hands to remedy in a great measure.

Smokeless firing cannot all of it be done by circulars from the officers. It takes in-

telligent co-operation on all the points. More of the requirements in a mechanical way are overlooked than should be. Take the roads where it is a success, and you will find that all hands enter into it and keep at it right along, till it shows good results both in comfort and economy. It can't be done right off on any but the favorable runs, but practice makes perfect in the long run.

"But you have not told us how to fire without making any smoke yet," you say.

Well, now, that depends on what you are looking for. If it is printed information, there is lots of it in circulation, so it need not be repeated here. If it is a trial on an engine, that depends on yourself.

The conditions of the engine and the way she is worked to handle the train properly cut a big figure. In some cases it seems impossible to do much on the first trial, but try, try again, is a good plan. Don't wait till everybody else has done their part before you start in; get at it yourself, no matter what position you hold. I am sure the American engineman is equal to this work, and will make it a success when he gets down to the business.

Special Floor Boring Machine.

Another heavy tool recently built by the Newton Machine Tool Works, of Philadelphia, for the Brooks Locomotive Works is shown in the accompanying engraving. It was designed for boring piston-valve chambers in the saddles, and a face mill is then put in the bar, and, after the table is turned a quarter revolution, the spots for steam and exhaust pipes are milled off.

The size of the machine can be appreciated when it is known that the table is 6 feet in diameter. It is moved by gear and pinion, and is provided with an index for quartering. The bar can be raised to a height of 48 inches over the table, while the head has a vertical movement of 30 inches and transverse movement of 48 inches. The boring bar is 5½ inches in diameter, movement of 50 inches and eight changes of feed. The milling feed is of the Sellers friction-disk type, so any feed is obtainable. The whole tool weighs 43,000 pounds.

Remarkably Fast Run Made 46 Years Ago.

In these days of flyers, when the speed of engines is a general topic of conversation among railroad officials, it is interesting to read this clipping from the *Scientific American* of the issue of July 2, 1853:

"A locomotive dispatched from La Porte to Chicago for a physician to attend Robert Doxtader, president of the road, who died at that place of apoplexy, ran the distance and back in 1 hour and 40 minutes. The distance is 58 miles each way, making a speed of 116 miles in 100 minutes. This is fully up to, if not superior to, the speed daily attained on the English Great Western between Paddington and London."

This time was made on a section of the Lake Shore, and the officials of that road take pride in pointing out that the road had as far back as 1853 engines that could reel off the miles at the rate of 69.6 miles an hour.

The above mentioned run was made by an inside connected engine with four 6-foot driving wheels; cylinders, 13 x 20 inches; a wood burner, carrying about 120 pounds of steam; although, as there were no steam gages used on the road, it could not be definitely stated what her pressure was. The engine was built at Manchester, N. H., and was run by Engineer Wm. Huxley. The name of the fireman or train crew was not known to our informant. The round trip was made in exactly 2 hours, of which 20 minutes was used in turning the engine, switching the coach and waiting for the doctor. The depot was at Van Buren street, as it is now, and the turntable located at Twelfth street.

The track was laid with T-rails, but was in very bad shape; so bad that Mr. Doxtader had shortly before issued orders for the work trains to work Sundays also, beginning on the following Sunday.

This information was given us by Engineer Henry E. Stone, of the Lake Shore & Michigan Southern Railway, living at Elkhart, and running a passenger engine on the Kalamazoo division. Mr. Stone is now in the fifty-third year of his railroad service, having begun on the Mad River Railroad on May 10, 1847, and came on the Michigan Southern & Northern Indiana Railroad in 1851, but was not there continuously till March 19, 1867. He is hale and hearty yet, making his regular runs. The reminiscences of old-time methods of railroad work which he relates are very interesting.

One of the engines he fired and ran while on the Mad River Railroad was the first engine built by the Rogers people. One of them was outside connected, and had the throttle and reverse lever located on the left side of the rear end of boiler. This engine was named "Sandusky." She was very smart, and did better service in proportion to her size than the large engines of the present day.

Tests of Brake Shoes.

The Standing Committee of the Master Car Builders' Association on Brake-Shoe Tests has decided to make another series of tests at an early date, which will include only brake shoes of new kinds that have not already been tested by the committee, and which may properly be considered as being in the market, or having some considerable use on some railroads.

All brake shoe manufacturers who wish to avail themselves of this opportunity to have their shoes tested should communicate at once with the chairman of the committee in reference to the details of the test, and should state in their communication to the chairman to what extent their shoe is in use.

Communications should be addressed to the chairman, Mr. S. P. Bush, superintendent of motive power, P., C., C. & St. L. Ry. Co., Columbus, Ohio.

S. P. Bush,
Geo. Gibbs,
R. P. C. Sanderson,
Committee.

A NEW HORIZONTAL FLOOR BORING MACHINE.

Piston Rod Roller.

Mr. Chas. Markel, one of our friends in Clinton, Iowa, sends us a blueprint of a new piston-rod roller that is being successfully used in the Chicago & Northwestern shops at that point. As will be seen, it fastens right in the toolpost, and is fed along by lathe carriage. The details are so clearly shown that further explanation seems unnecessary.

A Little Honest Criticism.

A correspondent writes:

In a letter received some time ago from a lad of mine at school in England, occurred the following passage: "I showed the photos to Mrs. H—— and she said they were very nice; she thought, however, that the chimneys were rather small for the body of the engine. I thought so, too, but I daresay they find it convenient to make them so."

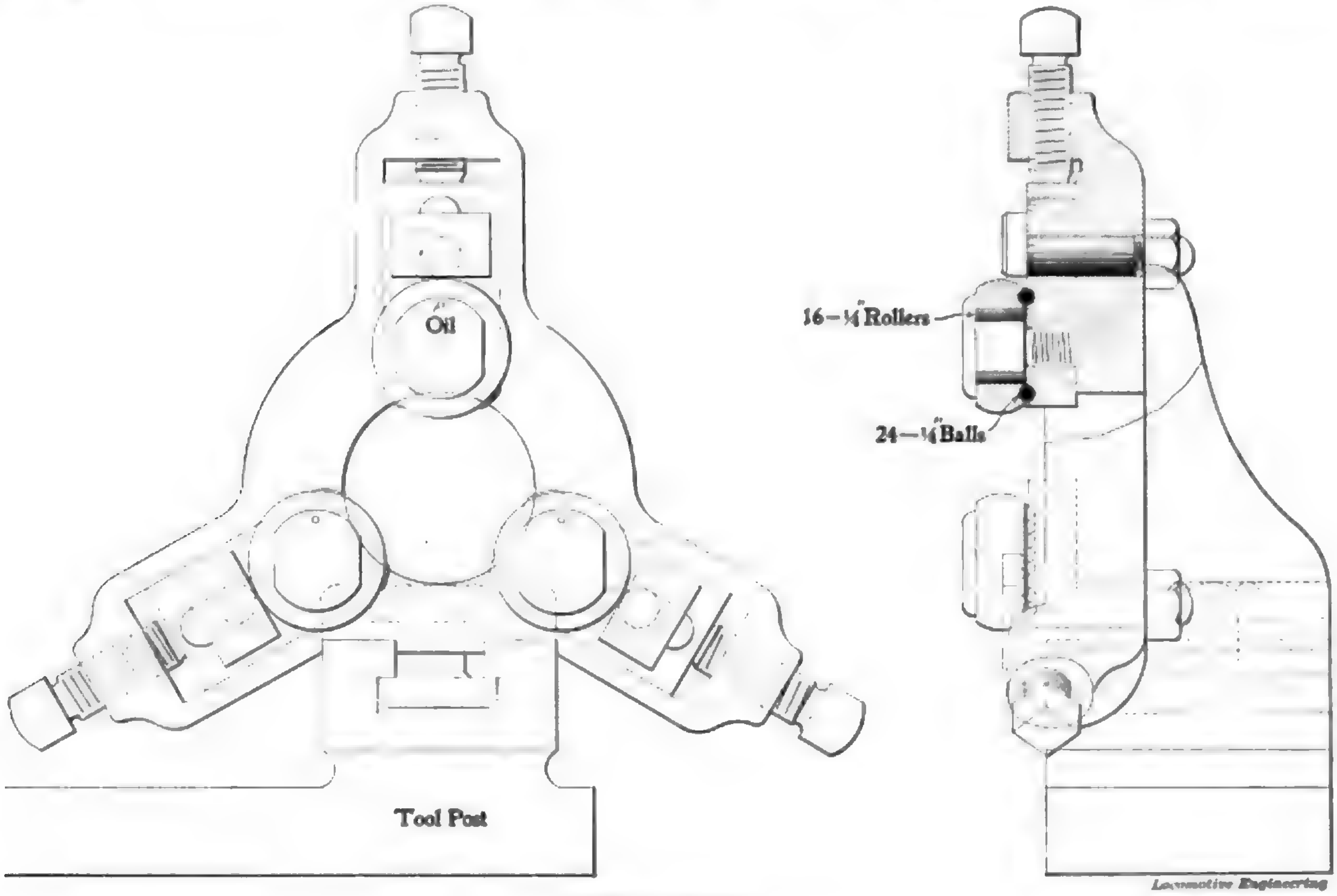
Now, sir, I don't know how this strikes you, but I think a pretty good sermon on "Criticism" could be preached from the above as a text. A boy thirteen years old has some engine pictures sent him, hears some honest, unbiased criticism and gives a little of his own—and there the matter ends. Some of the older critics, on both sides of the water, might learn a lesson from the above. The boy being unprejudiced (for in English schools a hatred of foreign countries is not instilled into the children), he was free to opine that we probably "found it convenient to make them so." Why don't grown-ups talk a little more in that strain, instead of blackguarding each other's practice because it's different from their own. In other words, let A be charitable enough to assume that B does so-and-so, not for the sake of being different from A, or because he is too ignorant to know better, but simply because he "finds it convenient to do so."

Success of the New York Central Ten Wheel Passenger Engine.

In the August number of LOCOMOTIVE ENGINEERING, we published line drawings and a half-tone engraving of "948," one of the New York Central ten-wheel passenger engines, then just going into service. We have heard from time to time that these engines were doing splendid service and that their performance has been away beyond the expectation of the management.

The engines have cylinders 20 x 28 inches, driving wheels 70 inches diameter and wagon-top boilers which provide 2,886.16 square feet of heating surface, and a grate area of 30.32 square feet. The tractive power in starting is a little over 27,200 pounds. An engine of that sort is calculated to do extraordinarily good work in train hauling. These have certainly justified proportions settled upon. They were built by the Schenectady Locomotive Works, and are displaying a great freedom from the small defects that cause the breakers-in of locomotives much annoyance.

We recently received from Mr. A. M. Waitt, superintendent of motive power of the New York Central, a blueprint showing one of these engines hauling sixteen passenger cars, nine of them being Wagner cars of the fullest capacity. The total length of the train was 1,212 feet, and the total weight 916 tons. This train was the Southwestern Limited. The run was made from the Grand Central Station to Albany in the scheduled time of 3 hours and 15 minutes. The engine seemed perfectly up to the capacity of the train, and could probably haul a car or two more, under favorable conditions.



PISTON ROD ROLLER.

The Baltimore & Ohio Railroad have made a radical change in their method of running dining cars, and the new plan is meeting with popular approval. Beginning with June, all meals, except dinners, have been served on the "a la carte" plan. Hitherto on the main line all service was at the uniform rate of $1 per meal. Two new dining cars have been built and have been in service since July 1st, so that all through trains are now provided with first-class dining cars. An extension of the dining-car system has also been made between New York and Washington, by which the train leaving Washington at 1 P. M. and the Chicago express leaving New York at 1.25 P. M. will have full dining-car service.

General Correspondence.

All letters in this Department must have name of author attached.

A Mexican Locomotive in Gala Dress.

I have seen photos of engines decorated for different occasions in *Locomotive Engineering*, so I send you one of Mexican Southern engine No. 8, which I think will compare favorably with any that I have seen. The engine was decorated for September 16, which is Independence Day of Mexico. The steel engraving in front of headlight is of President Diaz, the ones on sides of tender are of Hidalgo, the Washington of Mexico. Cannons and rifles are made of wood, suitably painted and bronzed; there are also small drum and drumsticks, bugle and belt of cartridges, pyramid of cannon balls, buckets on cannon rammers and sponges, all of which can be seen in photo. The engine took a passenger train from Pueblo to Oaxace on the 16th. N. Barrett.

Pueblo, Mexico.

MEXICAN LOCOMOTIVE IN GALA DRESS.

Definition of Time-Table.

"Define a time-table" is one of the prominent features of the catechetical examination propounded by the transportation department for candidates to answer who are aspirants for promotion. The inability to give a lucid and logical explanation of this interrogation has wilted many an aspirant's ambition. This is evident from the fact that all railway journals are now and then asked to give their version of a time-table.

This is the rule the writer has formulated to define a time-card: A time-table is the general law governing the movements of trains. It designates the time or arrival, or departure, or both, of all regular trains at all stations.

A time-table controls the movements of irregular trains as well as the regular scheduled trains. It designates, or indicates, the time regular trains will be at certain given points, and therefore shows the irregular trains what margin they have to work on before infringing on the time and rights of the regular trains.

The "Standard Code of Train Rules" is by no means perfect and free from criticism. The writer entertains the opinion that it would be a wise plan to discuss the faulty rules in Locomotive Engineering, that railway employés, especially those who are expecting advancement, may be aided in obtaining a more thorough knowledge of those rules.

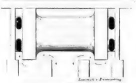
The technical discussion in the air-brake department of this journal has accomplished in this branch excellent results. A similar treatment of the train rules would have an equally beneficial effect. The efficient railway employé aims to be thoroughly informed in train service, as well as in air-brake and other mechanical appliances. James Francis.

Carbondale, Pa.

[We shall be pleased to give room for the discussion of this subject, so important to trainmen.—Ed.]

Double-Ported Piston Valve.

Having much to do with valves and valve gearing, I was of course interested in the article appearing in your late issue relative to double-ported valves. The article in question brought to mind a valve which I had occasion to design some years ago for a specific purpose. I send herewith a rough sketch, altered in some details to conform to dimensions of ports as given in your issue. The result is a double-ported piston valve which, if it can be packed for steam usage, will conform to the requirements as outlined in the article referred to. Little explanation is necessary. The holes appearing in the annular



DOUBLE-PORTED PISTON VALVE.

grooves surrounding valve are in direct communication by means of a passage through its center.

I should hesitate, personally, before using such a valve in any engine, as a somewhat varied experience goes to show me that the inner clearance is altogether too large and likely to be productive of noisy running, making the cure worse than the disease. In my own practice I set all valves line and line inside, and find other methods of taking care of the exhaust and back pressure. Lincoln A. Lang.

Yule, N. Dak.

Diseases of Injectors.

In reply to the article of L. Kaczander in the October number, I will say that if he will read over my article in the September number he will not find one opinion on the merits or demerits of the Monitor injector.

I did not start in to discuss the merits or demerits of any injector, and those injector makers that I have applied to so far for cuts of their injector have favored me with all the necessary matter possible, for which I thank them.

I don't think Mr. Kaczander will attempt to say that the Monitor is perfect, or that there is any injector perfect. All machinery has its weak points.

Mr. Kaczander says, "To mend slight defects like these would seem to be borrowing a great deal of trouble," etc.

Does he think it would be good policy for a fireman to be called up for an examination and the master mechanic would ask him what he would do if his right injector played out, for him to proudly exclaim, "I would use the left one," and for the M. M. to answer, "Yes, that would be all you could do."

In conclusion I would say that I will endeavor to treat every article about injectors in an impartial manner, from a

practical standpoint let it be understood, without any discussions on their merits or demerits.

If Mr. Kaczander had understood that there would be other articles about diseases of other injectors, he would not have found room for criticism when no reflections were intended.

Oskaloosa, Ia. A. A. LINDLEY.

Action of Driving Wheels in Rounding Curves.

A correspondent, in the September issue of your paper, asks whether there is any slip on either the inside or outside driving wheels of an engine in rounding a curve. I contend that unless the curve be very sharp there is no appreciable slip. We are all aware that there is a bevel on the tires of all rolling stock, declining from the flange to the outer edge of the wheel, usually having an inclination of about 1 in 20.

On a straight stretch of track the engine adjusts itself so that the rail makes contact with the tires at points where the perimeters, if measured, would be found the same.

Now, on entering a curve, it will be noticed that the locomotive climbs up against the cant of the road, so that the flanges on the wheels have a tendency to press against the outer rail, thereby relieving all skidding by the "coning" effect produced since the wheels of the engine on the outer rail are running on a greater diameter than those on the inner rail. The track is sometimes laid slightly wider in gage on a curve to obtain the maximum benefit from this "coning."

G. LLOYD JONES,
Std. I. Ct., City of London Electric Light Company.
Bankside, London, S. E.

In reference to the slipping of drivers in passing curves, I would like to prove that the inside drivers must be the slipping drivers.

The centrifugal force of the engine, caused by its great weight moving in a curved path, would cause the flanges of the outside drivers to bear very heavily on the inside of the outside rail. This must be especially so at high speeds and in passing short curves.

Then, as the outside rail is always placed higher than the inside rail, the engine would tilt toward the inside of the curve. Then the centrifugal force of the engine would tend to lift it up on its outside drivers, taking part of the weight off the inside drivers and putting more on the outside ones. For these reasons the outside drivers would have greater adhesion to the rail than the inside ones.

Therefore the inside drivers must be the slipping drivers. A. H. ZIEGLER.

Riverside, N. J.

On page 398 of the September number a Mr. J. J. Pharr wants information in regard to driving wheels and their action on curves.

Under his signature you give a few words of explanation. Now, this is where I would like to have a little information myself.

I have been taught that car and drive wheels had their tread beveled in order to overcome the conditions met in curves, viz.: that while the outside wheel hugs the rail and the bearing or point of contact is near the flange, which has the largest circumference, the inside wheel is bearing on the part which has a smaller circumference at that particular time than the outside wheel, which would allow the outside wheel to travel a greater distance in the same time than the inside wheel, and consequently accounts for the difference that each one travels.

Now, if this is all wrong, I would like to know why the tread of driving and car wheels are beveled.

GEORGE W. WOOD.
San Diego, Cal.

[The wheel tread is beveled on the theory that it will act as our correspondent describes, but most railroad mechanical men believe that there is more theory than practice about it. The subject has been repeatedly discussed at railway mechanical conventions, and the drift of opinion always was that the coning of the tire or wheel tread did no good. It might be of some advantage when the tire or wheel was new, but the inevitable wear took away in a few months the theoretical benefit.—Ed.]

Port Openings of Locomotive Valves.

In recent years, as experience has been gained by locomotive builders, the valve gears have been persistently strengthened, under the common belief, as some writers would have us informed, that with weak and elastic gears, the port openings are seriously reduced in area by the lagging of the valves, induced by their excessive friction against the valve seats. A number of articles, written in support of this theory, and some of them accompanied by indicator diagrams, which, under the fallacious reasoning of the authors, give an apparent plausibility thereto, have been published.

It is strange that these writers never seem to have taken into account the fact, that before the successful adoption of the piston and balanced slide valves, locomotives were operated with unbalanced valves and weakly constructed gears, which were also designed for a much shorter valve travel, and, consequently, smaller port openings. As the full port opening is effected at the end of the valve stroke, and in most of these engines did not exceed ¼ inch in the earlier cut-offs, we may almost say that there was no margin at all for any lagging of the valve, which, if possible, in spite of its inertia, could easily amount to more than the entire port opening, and without taking into account the lost motion, sustained by years of wear and tear, which, unless taken up by the momentum of the valve, would, with every reciprocating movement, reduce the port openings to the exact extent of such wear of its numerous and complicated connections.

With balanced valves, operated at high speeds, it is probable that at the point of greatest deceleration, or about three-quarter stroke, there is a considerable advance movement of the valve, taking up all available lost motion and elasticity of the valve gear, and maintaining the greater part of it practically to the end of the stroke, where the pause in the valve movement would allow the gear to resume its normal position, only to lose it again under the accelerative stresses of the next stroke. These strains, induced by the inertia of all the moving parts of such an intricate mechanism, must test the strength of the operating gears much more seriously than the unavailable friction of a balanced valve.

Unbalanced valves subject their gears to much more serious strains during the first half of the stroke, as the frictional stresses are added to those of acceleration, but partially balance those of deceleration during the latter half of the stroke. If, in spite of this fact, unbalanced valves can still be operated with only ¼-inch designed port openings, there is certainly no occasion for alarm on this score when piston and balanced slide valves are used.

During the test of a locomotive using an exceptionally heavy piston valve, on the Intercolonial Railway of Canada, a few weeks ago, the strain on the valve gears was so great when drifting down hill at high speeds, that the lower notches of the quadrant could not be used at all, and, in spite of all precautions, the eccentric rods were broken several times. The difficulty was partially removed by cutting out the cast-iron pipe-shaped connections between the valve pistons, but was finally cured by increasing the capacity of the cylinder cocks, so that they could be used when fully opened, for relief valves, and without changing the working position of the reverse lever. This engine was designed for a 7-inch valve travel and a cylinder capacity of 21 inches diameter by 28-inch stroke. As the driving wheels were only 56 inches in diameter, and the revolutionary speed proportionately high, the immense relief afforded to the tension on the valve gears by this arrangement will be readily appreciated by all experienced engineers.

The steam-engine indicator is not a reliable instrument for measuring valve port openings, and certainly was not designed for that purpose. In locomotives where the compression usually approximates the steam-chest pressures, a very small port opening should be sufficient to complete the highest possible initial pressure, if not

prevented by cylinder condensation; but as this latter factor in the economy of steam consumption is an extremely variable one, and dependent on conditions existing in the boiler and furnace, as well as the cylinder, it is not surprising that the delicate little instrument makes so many exasperating puzzles for the exercise of unwary imaginations. An engine working with falling boiler pressure is not nearly so efficient as when the pressure is rising, although it may average the same, for a given time, in both cases. The indicator will show the differences in the effective cylinder pressures; but how would the writers mentioned distinguish between such recorded losses and those that they would attribute to a distorted valve motion?

In order to settle this question definitely, it is only necessary to determine whether the valve strokes are longer or shorter than those designed for the engine tested. A valve-motion indicator similar to those used on some types of automatic engines could very easily be attached to the valve stems, and the length of the valve strokes measured thereby compared with those designed for a given position of the reverse lever. W. F. CLEVELAND.

Philadelphia, Pa.

[In regard to the contention raised by our correspondent regarding the accuracy of the theory that the valve opening is frequently reduced owing to excessive friction, we would remark that it is not merely a theory. It is a fact demonstrated by actual experiment on the experimental locomotive at the Purdue University. Not only was the testimony of indicator cards taken to prove this, but a valve-motion indicator was used, which showed the varying travel of the valves under various conditions of lead and dryness of the rubbing surfaces.—ED.]

Trouble With a Lubricator.

W. J. H., North Platte, Neb., says: "The air-pump feed of a late Nathan triple-feed lubricator fails to feed under all conditions. On examination, found tallow pipe connections to be open both at the steam pipe to air pump and at lubricator. Choke plug was open. Lubricator would act as follows: When not feeding the cylinder feeds, glass would fill with water but no oil would come from feed. When feeding cylinder feeds, water would all leave glass through feed nipple. I examined lubricator thoroughly and did not find anything wrong with it. I was careful to note if there was any dirt or sand holes. Now, you probably understand that the lubricator has one oil pipe and one oil cavity for the three feeds. What caused this? Lubricator is now feeding O. K."

The fact that the lubricator worked O. K. afterward with no changes or repairs on it shows that the cup was all right. Very likely the steam supply from the boiler was shut off or the pipe stopped up somewhere so the only steam supply came from the air pump steam pipe, if the water valve from condenser to oil tank was also closed or opening stopped up, the steam would go down through air pump feed glass to get into the oil tank.

You do not say if this peculiar action took place while in the house or on the road; whether the steam supply from boiler was open or shut, nor about the valve between condenser and oil tank. To tell just what was the matter without knowing all the conditions is only a guess at it.

The matter was referred to Mr. G. A. Bischoff, of the Nathan Company, who says:

"The trouble was probably caused by not having full steam pressure on lubricator when engine was moved out of roundhouse. The *water valve* was opened, but not the steam. In this condition there was a direct opening from the lubricator to steam chest through the water valve, drawing the condensed water from the condenser and then siphoning the oil through the water tube out of oil chamber. This will cause the water from sight feed glasses, together with any oil which may be on top of same, to be drawn into oil chamber. This will last until oil chamber is solid full, then the feed glasses will fill up with water again, and if the condenser has in the meantime regained condensed water, the cup will feed oil again.

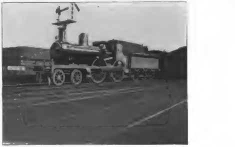
"The remedy is open the steam valve *full* before the engine is moved."

Liquid air may prove to be superior to any other medium as a means of transmitting power, but little in its favor has yet been demonstrated, although its friends claim everything in sight. The latest claim was that liquid air could be used to great advantage as a blasting medium. A test of this was made in Austria lately, and the liquid air proved the worst kind of a failure.

An Irish Locomotive.

A warm admirer of LOCOMOTIVE ENGINEERING in Ireland has sent us some photographs of Irish locomotives, from one of which we reproduce the annexed engraving. It was a poor photograph, and does not do justice to the engine. Our correspondent seems to think that we militate against Irish rolling stock by not illustrating more of their engines and cars, when we are in the habit of illustrating the rolling stock of other foreign railroads frequently. That is not the right reason why we do not illustrate Irish locomotives and cars; it is because our friends in that country do not send us photographs or drawings.

Our correspondent says that the engine shown was one of four built for the Dublin, Wicklow & Wexford Railway, designed to handle the main line express traffic between Dublin and Wexford. The engines have cylinders 18 x 26, and the driving wheels are 72 inches diameter. The boiler carries a pressure of 150 pounds per square inch, and the heating surface is 1,026 square feet. The grate area is 19 square feet. The weight of the engine is 89,600 pounds.



AN IRISH ENGINE.

"My Young Fireman."

After the "strike of '73" I drifted about for a while, and finally anchored on a small "north and south" coal road in northern Ohio, and although I considered myself lucky to find employment during those hard times, the change from running a first-class engine in passenger service on a trunk line to running a dilapidated mogul on through freight, hauling coal on a "cross cut" road, was so full of unpleasant contrasts that, in spite of all the philosophical argument I could invent to relieve myself of the burden of responsibility for the changed conditions, my heart at times grew sick. Having been long accustomed to a good engine, good coal, the pick of the freight firemen and other good

things, I was not well fitted for service on a "stake" road, where these conditions and privileges were wanting. Even that companionship that 'tis said affords consolation to the miserable was denied me—through my own fault, perhaps, for I had no desire to become intimately acquainted with any of the class of "stake men" who were coming and going; and while the greater portion of them seemed miserable enough to afford me fitting companionship, the "pride of better days" held me aloof from them.

But necessity bade me stay, and I was just about becoming resigned to my new surroundings, when, as I was looking the "51" over after a fairly comfortable trip, the master mechanic approached me and said: "William, the fireman whom you now have is to be promoted, and this young man (pointing to a boyish-looking fellow close by him) is assigned to your engine." Now, the fireman I had at that time was a man of considerable experience. He was by long odds the best man who had yet fired the "51" for me; and to think of his being substituted by an insignificant-looking, undersized boy fired me with indignation, and I told the master mechanic, in language more forcible than elegant, that I wanted a man to fire for me, and not a "kid"; that the engine was hard to fire on such a heavy run, also that I was tired doubling the hills because of engine failing for steam. "But he has good letters, William," said the master mechanic. "Anyone can get letters," said I, hotly. Anyhow, he was "marked up" to go on the "51" the next morning.

I went home in no pleasant mood that evening. The troubles of the following trip were vividly pictured in my mind, and when next day I laid my dinner bucket on the corner of the tank before taking hold of the handles to assist in getting up, I peered into the gangway to assure myself that the change of firemen was not a dream. It was a painful reality. There was my "kid"—height, about 5 feet 4 inches; weight, about 120 pounds; age, about twenty years. These features I regarded as being all decidedly against his chances for success; and to tell the truth, I wanted to see him fail, if for no other reason than to get even with the master mechanic, who seemed so confident that his "young man" would do all right.

When I got on the engine there was no greeting exchanged—for my part of which I have reproved myself many times since. My silence was stamped with mulishness; his with manly independence. While oiling around I noticed that he had greased the "bright work" and jacket in anticipation of rain; both dampers were closed, which was not the practice on that road; the fire was all built in the forward end of the firebox, and the "51" was making no noise at the pop, something unusual at fifteen minutes before leaving time. I heard him ask the head brakeman if it was a very hard pull out of the yard, and upon being told that it would be "hammer and tongs" for the first forty miles, he proceeded leisurely to arrange the fire; after which he "cracked" some coal—in fact, he had been "cracking" coal for nearly half an hour before that time; and when I told him, just before we pulled out, to never mind the lumps, that the "51" would break them fine enough, he merely nodded, and kept on cracking. I also told him that she was a hard steamer; that she burned lots of coal, which was of very poor quality, and that he must fire heavy and shake the grates often to get any steam.

Having discharged my duty of giving the new man all the information at my command, I whistled off, and started what proved to be the most memorable trip of my forty years of rairoad experience.

Somehow we managed to get out of the yard all right, and after passing the "yard limit board" I commenced to give my attention to the steam and water gages (we had no water glass). It had always been close figuring to have steam and water enough to get to the summit, which was ten miles away, and where we met a passenger train. There was a switch 3 miles from the summit, where we were permitted to set off enough cars to enable us to make the meeting point, and we used it regularly. But the "51" was doing well. At no time did I have to shut off the water to get steam. The indicator on the gage seemed riveted at the 135 mark. Occasionally he would ask a question of the head brakeman, whose aid he had enlisted to keep him posted on the grades. He seemed to need no information from me. Judging by what I had already given him, he no doubt felt as though he could get along better without, for thus far he did just exactly the opposite to what I advised. He continued cracking the coal into small pieces, and kept me in constant fear of "losing the fire," as it was just dancing on the grates; and worse than all (it seemed so to me then), he was firing with but one and two shovelfuls of coal to each fire. That day we did not need to lighten our train to reach the summit, and when we got to Hillside there was a nice level fire about 5 inches deep; we had burned at least one-third less coal than on any previous trip, and I don't know how much more steam he could have made if necessary. At any rate, he kept her hot enough to thaw me out, and if ever man offered sincere apology to another, I did to the "boy," who had in so short a time elevated himself in my estimation by his manliness and skill, that, in so far as the art of firing the locomotive was concerned, I was only jack, while he was master. From Hillside to the end of the division the road was level. I worked the engine very light, but the indicator showed that same tendency to cling to the high-pressure mark as when she was working stronger. I tried to engage him in conversation when we were rolling along on time, but he had no desire to talk. I learned from the brakeman that "our boy" had been firing on a trunk line, but was disqualified for being a minor. When the trip was ended I renewed my apologies for the manner in which I had treated him when we first met. He listened to me, but merely said, "That's all right." But I knew it was not all right, yet I hoped to make it so later on. The next trip I went to work an hour earlier than usual, in order to make apology to the master mechanic, and tell him how completely I had been crushed by his "young man." I told him all, and, like a true penitent, asked his forgiveness. He was a kind-hearted old gentleman, and he addressed himself to me in the following words:

"William, when you declined to take the proposed change in fireman with good grace the other evening, I sympathized with the young man whose feelings you had evidently sorely wounded, and I informed him that he was to go out on engine '72,' on the local freight; for I will confess that he did look a little light for a mogul, and I had changed my mind about sending him on the '51,' considering the manner in which you acted towards him. He thanked me for what he termed my kindness, but said that he would prefer to go on the '51,' adding—and there was a tremor in his voice as he spoke—that 'we,' meaning you and himself, would get along all right; so I let him go out with you. I wanted to see him succeed as he did, and very much regret to say that he resigned this A. M., without any explanation, before I arrived at the office. I would have induced him to stay if possible. Yes, William, I forgive you for the offense you gave me. I ran an engine for several years myself, and I must acknowledge that there is no occupation I know of that tends in such a large measure to produce an irritable disposition as running an engine under the conditions that exist on some roads. Our own road, I am sorry to say, is not an exception; and when you came in, tired, hungry and partly baked, the other evening, I could make some allowance for your uncivil manner, when I mentioned the change of fireman to you. The young man could not be expected to be so considerate. He seemed to be a sensitive, high-strung fellow. He felt the insult keenly. He seems to have reaped all the satisfaction he desired. The manner in which he has done it is commendable, to say the least, and stamps him as truly a Spartan as though he had won laurels on the field of battle. He certainly has taught you one lesson that you should never forget, and that is, to always treat the stranger with respect."

I thanked the Old Man for his forgiveness and humbly proceeded to prepare the "51" for another trip.

I have made many trips before and since that time, have had some experiences that were sad and many that were exciting, but the impressions made on my mind by

events relating to that particular trip will be still distinct when others have become effaced. THOS. P. WHELAN.

The Franklin Institute.

The seventy-fifth anniversary of the founding of the Franklin Institute was celebrated at the National Export Exposition in Philadelphia during the week of October 2d to 7th, inclusive. Among the speakers were Mr. John Fritz, Prof. Coleman Sellers, Mr. James Christie, Mr. Wilfred Lewis, Mr. Charles Kirchoff and Admiral Melville.

Needless to say, all the addresses were good in their respective fields, and show the advances made in mechanics in the last three-quarters of a century to be almost marvelous, and we regret not being able to give more space to them.

The Franklin Institute has worked so long in its quiet way that its great work for the advancement of the practical engineering and science generally is not nearly as well known as it should be. Only those who have been connected with the work of the Institute fully realize this, and it is hoped that means will be taken to acquaint the mechanical world, through its trade journals, with the work accomplished.

Engineers Hiring Their Own Firemen.

In 1894 the Minneapolis, St. Paul & Sault Ste. Marie entered into an agreement with their enginemen which virtually put the hiring of firemen into the hands of engineers. There were a variety of restrictions imposed and mutual agreements were made between the company and the engineers, which were expected to increase the harmony of interests and insure justice all around. The company required that the fireman should pass an examination for sight, physical condition and education, while a certificate of good character was required.

The company agreed to hire no engineer unless he was recommended by three full-paid engineers in the service. They agreed to promote no fireman unless he was nominated by the engineer he was firing for and seconded by two other full-pay engineers. Such a nomination made a fireman eligible for examination on time-card and rules of the superintendent and on machinery by the mechanical superintendent. Men undergoing examination could have those who nominated them for promotion in attendance.

It was expected that this system would introduce a sort of millenium among the enginemen, and that the bickerings not unknown on some roads would be entirely banished from the "Soo." There was much conflict of opinion on the utility and justice of the system when it was first introduced; some asserting that it was the most enlightened advance ever made in railroad operating, while others predicted that it would prove a monumental failure. At the time we said: "Everything depends on how it is done. Let us hope that the engineers of the 'Soo' are manly, upright and just enough to give the plan a fair, impartial trial, and let it win or fail on its merits."

It seems to have failed, for after five years' trial the plan has been abandoned.

A Four Piston French Locomotive.

We have received from some person in France illustrations and description of a locomotive constructed on what is called the "Systeme Aime Robert." The purpose of the engine is to attain very high speed, and at the same time have the moving parts entirely balanced. It is rather a curious sort of a machine, and has two pistons to each cylinder, one transmitting the power through the front head and the other transmitting the power through the back head. The idea is by no means a novelty, but there are unusually strong claims made for the utility and practicability of this motor.

The description says: "High speed being the order of the day, it is very important to realize the problem when in fear of danger that the movement of the locomotive may be balanced in a fashion to take up the inertia, and applies a strong force without augmenting the dimension actually in use. The Robert systeme of locomotive realizes this problem in a manner very simple and satisfying. She is less complicated, more powerful and more certain. In fact, the movement by their special arrangement is in perfect equilibrium. There are four pistons, two cylinders and two balances. The power can be augmented without increasing the number of pieces."

We hardly think that the engineering world is going to make a sensation by rushing to get locomotives built on the Robert systeme.

Case Hardening.

John Buckley has presented at the last convention of the National Railroad Master Blacksmiths' Association the following paper:

"The process of case hardening has not changed materially for the past few years. The principal materials used remain the same: Granulated rawbone, hydro-carbonated bone black, black oxide of magnesia, sal soda, charcoal and salt. These materials are commonly used in railroad shops and give much satisfaction if they are carefully and properly handled.

"For pins and bushings, and such light work as is required for immediate use, we use the New York Specialty case-hardening powder; this we found to be greatly superior to potash.

"The work which is to be hardened can be packed in cast or wrought iron boxes, sealing with fire clay or mud, so as to prevent the gases from escaping as much as possible. The pieces to be hardened should be placed about 2 inches apart in the box. The vacant spaces are well filled and packed with the material you are using for case-hardening purposes. Should your box be supplied with heavy work, as crank pins, guides, etc., fifteen to twenty hours of steady heat is necessary in order to secure best results. If, on the other hand, you have light pieces, as links, link blocks and pins, eight to ten hours will be sufficient to subject them to a good heat.

"This class of work we place in the furnace about 8 o'clock in the morning and heat it all day. At night we close up the furnace, letting the box remain over night and remove next morning. Reheat this work and cool in cold water. We have secured good results using granulated rawbone. If using hydro-carbonated bone black, pack the pieces in a box and seal as before.

"Furnaces for case hardening should be so constructed that the boxes will not have to be raised or lowered while being put into or taken from the furnace. The heating space is near the ground. The firebox and ash pan are below the surface. This refers to a furnace heated with soft coal. If the furnace is outside of a building, a stack or chimney, about 16 feet high, will furnish draft enough to heat the boxes without aid of a blast. Case-hardening furnaces which are heated with fuel oil are of a very different construction, the boxes being generally heated from the top; with coal, in most cases, it is from the bottom. The cooling tub is arranged so as to admit cold water from the end near the bottom, the cold stream thus running lengthwise along the bottom of the tub. This cold stream forces the hot water to flow over the top of the tub.

"When cooling guides or long pieces, strips or bars of iron should be laid in the bottom of the tub, in order to keep the work about 2 or 3 inches from the bottom of the tub; in this way the cold stream flows under the work which is being cooled."

For removing the incrustation of boilers, a French engineer, M. Savreaux, now announces an improved method. According to this, after extinguishing the fires the boiler water is blown off very gradually, at the same time admitting an equal volume of cold water, so that the water gage shows no change of level. As soon as the water has in this manner been sufficiently cooled down, it is suddenly blown off. It is this latter operation which removes the major part of any incrustation which may be present, what remains being very easily detached by scraping. It is necessary, however, that the cleaning of the boiler be taken in hand immediately upon completion of the blowing-off operation, as otherwise the furstone will harden and adhere again to the boiler plates.

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About Subscriptions.

Subscriptions cannot now date back of May, 1899, as the supply of previous issues is exhausted. Unless otherwise stated, they will begin with current month. No need of waiting till first of year; they can begin any time.

Something About the Premium Plan.

The question of wages is always an important one to both employer and workman, and the satisfactory solution of this does more to produce harmony and contentment than anything we know of. True, it isn't the only thing to be considered, for fair treatment (aside from wages) and a comfortable place to work in are also necessary for the best all round results.

Taking wages alone at present, it is the aim of the employer to pay as little for labor as possible, and of the workman to obtain the highest rate he can. In other words, it is simply a question of supply and demand, the same as in buying shoes or sugar. When there are two jobs to every workman wages are high, but when there are two workmen after every job we all know the result.

Starting with this, we have the problem of finding the fairest means, to both parties, of paying for work done. The employer wishes to get the maximum output from his machines, which cheapens the price per piece, even at the same wages, for the cost of running the shop is lower and the returns from the machines are increased.

In order to stimulate the workman to greater efforts and to allow the greatest output from the plant, piece work was introduced in place of day wages, and the effect of this was as varied as the natures of the men concerned. In places where the employers realized the gain from an increased output of their plant and were satisfied to find the price per piece materially reduced from the old method, the men made much higher wages than before, and everything was happy on both sides.

But the idea of a shopman making over $3 a day was too much for some, and cutting of piece rate commenced. Nor were the men entirely blameless in this, for some would rush and slight work in order to make a big week's wages—"spoiling a good thing," as it was called.

It is well known that very few first-class workmen dare work up to their limit for fear of a cut in price, and this operates against both parties—preventing the man from earning all he might, and keeping down the output of the plant.

It was to obviate this, and yet to insure to both parties the fullest returns, that the so-called premium plan was devised by Mr. Fred. A. Halsey in about 1884, although he did not have an opportunity of testing it until 1890. This enables the best workman to make more than his slower companion, and stimulates them all to do their best by a substantial reward. At the same time, there is a visible return to the employer, and the rate should always be so fixed that it is not to be changed, unless a change is made in the method of working which in itself reduces time required. There are of course, isolated cases where straight piece work is working with entire success, due to unusual tact on the part of the management, or other condition, but these are not common.

The premium plan divides the saving between the employer and the workman, benefiting both, and showing each the exact amount of saving or earnings. Before applying this system, it is necessary to carefully determine the proper time allowance on each piece, so that there will be no need to disturb this, as it is the changing of rates which makes men uneasy and dissatisfied. For this reason the shops which are using piece work at present are in better position to adopt the premium plan than those which are using the old methods.

Taking the case of a railroad shop which is so systematized that the cost of doing certain jobs is known, even if piece work is not used, and it is a comparatively easy task to apply the premium plan, taking care to set the time limits low enough, so that it will not be necessary to reduce them, yet high enough to offer an inducement for the good workman.

A certain railroad shop we know of is using the following rates for some of its work, and with those as a basis we can easily show just how the premium plan would work in this case:

Boring one driving box, 35 cents.
Injector check joints reground, 37 cents.
Shoes and wedges refitted, $4.50.
Turning pair of tires, $3.

The time limit can be very easily set from these, providing, of course, the piece prices are fair to both parties. Suppose we take the time for turning tires as an example, on account of the even figures, and we set the time limit at 10 hours. This allows the workman 30 cents an hour for his time, if he just finishes it within the time limit. If he takes more time explanations are in order, but he gets the 30 cent rate for the time worked. He forfeits any premium, however, and if the time is fairly set, a good workman will never exceed the time limit, unless there is some accident to machine or similar trouble. Calling the premium one-third of the time saved, and assuming that the man turns these tires in 8 hours, we find things like this:

Time worked, 8 hours, at 30 cents =	$2.40
Time saved, 2 hours, at 10 cents =	.20
Total for 8 hours work.........	$2.60

Rate per hour on this job, 32.5 cents.

While this has raised his hourly rate 2½ cents, the company has saved in two ways. It has saved 20 cents per hour for two hours, or 40 cents, and has gained the use of the wheel lathe for two hours besides—thus increasing the output of the shop. In other words, they have only paid $2.60 for turning the tires, and have two hours left towards turning another pair, while the workman has made 20 cents more in 8 hours' work than at the old rate. He has two hours left for other work, and if he keeps on turning tires at the same rate he will have earned at the end of the day ten times 32.5 cents, or $3.25 instead of $3 as before.

Considering the fitting of shoes and wedges on the same basis, we have 15 hours as the time limit, making the rate 30 cents an hour as before. If a man does this in 10 hours the account stands like this:

10 hours at 30 cents =	$3.00
5 hours at 10 cents =	.50
Total for 10 hours work........	$3.50

Rate per hour on this job, 35 cents.

The company has saved 5 hours at 20 cents, or $1, besides having 5 hours' work at another job.

The more the man makes the more the company saves on each piece, as in the first case they save 40 cents on a pair of tires, and in the last $1 on fitting the wedges.

With this apparent saving on any job where the man makes more than usual, there is much less excuse for cutting the time limit, and in fact this should never be done, unless the method of work is changed.

Another good feature is that it can be applied to any rate per hour, and the proportion of saving allowed varied to suit any shop manager's idea. But, once set, it should never be decreased, as this destroys the confidence of the men, and reminds them of piece work, with its inevitable cut if wages increase too much.

Better Steamer Service for Canada.

Sir William Van Horne, of the Canadian Pacific Railway Company, has done a great deal to give Canada benefits which arise from the transcontinental transportation business, and he is solicitous to bring new benefits and new sources of gain to his adopted country. His latest scheme for the benefit of Canada is for a fast Atlantic service that he thinks would revolutionize travel. Briefly stated, his plan embraces the control of the Intercolonial by the Canadian Pacific and the establishment by the latter company of a line of fast ocean steamers plying between Liverpool and Halifax in winter and Quebec in summer. He would have a fast train equipped by the Canadian Pacific to run between Euston Station, London, and Liverpool, delivering the passengers to the Canadian Pacific steamers at Liverpool, with tickets guaranteeing close connections at all points and absolutely guaranteeing arrival on time at Hong Kong or Yokohama by means of fast steamers from Vancouver. To do this the Canadian Pacific would require a subsidy from the Canadian Government of $750,000.

That is a rather ambitious scheme; but there are several difficulties in its way that will not be easily overcome, especially the $750,000 subsidy. We are also inclined to think that the transcontinental passenger travel would not provide passengers sufficient to make a line of first-class ocean steamers pay.

We think if Sir William would proceed energetically to work up the natural advantages of certain Canadian ports as landings in the ferry between the British Isles and the American continent, that he might make a great success. The great mass of timid transatlantic voyagers count the time they are at sea from the hour they lose sight of the Irish coast until they see the coast of Long Island. That period of ocean gloom may be put down as about 150 hours. If, instead of making for New York, a modern steamer leaves Ireland for the St. Lawrence, the time from land to land is about eighty hours. It might be asked, when the reduction of time on the ocean voyage is so great, why have travelers not adopted the shorter route more than they have done? The answer is, the steamship lines trading between Britain and Canada are so miserably slow and so inferior in the provisions made for the comfort of passengers that most people would prefer to endure a much longer passage on boats where efforts are made to make the passengers comfortable. There are two steamship lines trading between the St. Lawrence and Europe. If a daring passenger takes one, he wishes that he had taken the other, and if next time he takes the other he wishes that he had stayed at home and gone fishing.

That transatlantic steamship business seems to us to be a weak spot in Canadian management and enterprise. If the Canadian Pacific Railway Company would throw all their effort and influence to the improving of existing steamship facilities, we believe it would profit them more promptly and with less outlay than the establishing of new lines. That would come later.

Heat Losses from Imperfect Boiler and Cylinder Covering.

"The Imprisonment of the Thermal Unit" was the name of a lecture delivered by Captain Wallace W. Johnson before the Railway Engineering Class, Sibley College, Cornell University. The lecturer took the stand that while engineering science has labored industriously and successfully to convert a potential power of fuel into heat with the least possible degree of loss, little effort has been made to imprison the heat generated till the time when it could be transformed into work. If anything is acting to restrain the free conversion of fuel into heat, the fact soon becomes known through even the crude evidence that the boiler is not making steam freely enough, and a remedy will be sought for. But when steam once generated is permitted to escape as through a sieve very little attempt is made to hold it back, unless the escape is of a visible character. If the owners or men in charge of a steam plant could see 10 per cent. of the boiler steam and 40 per cent. of the cylinder steam passing through the inclosing walls without doing any useful work, there would be tumult and shouting and effort directed to finding an immediate remedy. These manifestations of zeal to restrain waste of heat are not much in evidence in ordinary boiler and engine rooms, for the reason that the heat is stealing away like a thief in the night, and those responsible for its imprisonment fail to understand that anything is escaping. What is true of engine and boiler rooms in regard to the escape of heat is particularly conspicuous where locomotives and their boilers are concerned. In their case the losses are particularly great, because the conditions of operating expose the locomotive boiler and steam transmitting parts to more exacting atmospheric conditions than those found in other engines.

It will be an interesting and profitable mental exercise to follow the heat losses partly preventable that happen with a locomotive from the time the coal is passed into the firebox until the exhaust steam passes into the atmosphere. We have said so much lately about good and bad methods of firing that we need pay no attention to the man whose hand reaches from the scoop to the treasury of the railroad company. He is working on stronger lines of progression than any other person who has influence in saving or wasting heat. There is very little complaint made against the officials, who are responsible for the escape of heat units after the fireman has done his best to make the most out of every pound of fuel put into the firebox. This is not because this loss is not often greater than that due to the worst kind of firing, but because the waste does not readily appeal to the senses.

If you stand upon a station platform any day, summer or winter, and a locomotive passes at a lower speed than twelve miles an hour you will feel the warmth thrown off from the boiler and cylinders. Reflection will tell you that the engine moves along giving forth at all times a volume of heat into the surrounding atmosphere. Some engines are more liberal in heating the air than others, but nearly all of them send forth heat rays that can be distinctly felt six feet away. The principal source of this radiation of heat is the boiler, and the resulting loss is due to defective insulation. It is perfectly practicable to make and apply a boiler covering which will prevent the escape of any heat except through the proper channels, and that this has not been done is due to the fact that people in charge are not properly impressed with the magnitude of the losses now going on. To feel the hot air raised perceptibly in temperature by a passing locomotive ought to indicate that the losses from this source are serious, but no data are provided to tell what the aggregate amounts to. This ought to be supplied by accurate tests. Very little has been done to measure these losses, and all we have to guide us are rough guesses. Few locomotives steam so freely in winter as they do in summer, and the cause doubtless is that in cold weather a large proportion of the steam generated is wasted by radiation before it has the opportunity to do work in the cylinders. Mr. J. C. Hoadley, a well-known mechanical engineer, made some tests with ordinary boilers years ago to ascertain the heat losses due to uncovered and defectively covered boilers, and he found the loss as high as 12 per cent. It must be much greater with a locomotive rushing through the air at a high speed and forcing currents of air under the defective lagging. Considerable progress has been made within the last five years in the introduction of good sectional lagging that prevents the heat units from escaping through the parts where it is applied; but too much of the boiler still remains uncovered.

A surprising thing to us is that some en-

terprising railroad company does not make systematic tests to ascertain an approximation of the heat losses due to defective boiler covering. This could be easily done by taking, say, three engines and stationing them in an exposed position on a very cold, windy day. One might be covered with the best known kind of boiler lagging, the next with pine board lagging that had been some months in service, the other might have the boiler bare. The difference in the amount of fuel required to keep the steam pressure close to the blowing off point would give a good approximation of the value of efficient boiler covering.

If there is one part of a locomotive boiler that deserves more attention than other parts in the way of proper insulation it is the firebox. Yet the firebox has been more thoroughly neglected than any other part. This has come about merely because the firebox presented greater difficulties than the barrel to those planning or applying covering. The flat surface in front of the firebox gives good resistance for the wind to act upon. The chilling effect of the wind is so great during cold weather that the front of the firebox becomes a veritable condenser of the steam generated inside. Several railroad companies have succeeded in applying effective covering to the whole of the firebox, and there is no reason why others refrain from doing the same thing, except that the extent of the heat losses is not appreciated.

In this connection it would be well to caution railroad companies against using plaster boiler covering. The plastic part consists invariably of plaster of Paris, which is sulphate of lime. Under certain circumstances that sulphate becomes sulphuric acid, which attacks the boiler plates and causes dangerous weakening unless promptly detected.

There is doubtless serious loss of heat going on all the time from the cooling effect of badly covered boilers; but there is good reason for believing that even greater loss results from cylinder condensation. The best steam engineering authorities say that the result of careful tests proves that from 25 to 50 per cent. of the steam generated in the boiler is condensed before it can be utilized to do work inside of the cylinders. A considerable part of this loss is unavoidable where steam jackets are not in use, and is due to the cooling of the cylinders during the period of exhaust and the need for heating the metal again to the temperature of the incoming steam. To go more into detail: The steam in entering the cylinders goes into what is a partial condenser, and as saturated steam is ready to return to water as soon as the least portion of heat is abstracted, part of the steam becomes vapor and has lost its capacity for doing work. As expansion proceeds and the pressure decreases, the condensed steam inclines to vaporize, and it draws heat from the walls to aid this process. By the time the exhaust opens, that end of the cylinder has descended in temperature near to that due to the temperature of the boiling point at atmospheric pressure.

When the cylinders and steam chests are badly protected, and most of them are, this condensing process is much more active than it is where good insulation is provided. The saving of heat due to well covered cylinders and their connections is so great and the expense of imprisoning the thermal unit so trifling, that it is amazing to find the greater part of our locomotives with no lagging on the cylinder heads, bare metal where the steam passages are, and no intelligent or careful attempt to cover cylinders and steam chests.

In the course of a conversation the writer had lately with Mr. Aspinall, general manager of the Lancashire & Yorkshire Railway, but better known as locomotive superintendent of that railway, we learned several interesting facts about the difference between well protected and badly protected cylinders. Mr. Aspinall built a group of outside cylinder engines for switching purposes, all others on the line having the cylinders inside the smoke box. The inside cylinder engines cause no annoyance by dripping water from the cylinder cocks, but the new ones, with the cylinders outside, were such a nuisance in that respect that the designer thinks seriously of changing them. That is probably one reason why British locomotives, with their well protected inside cylinders, do their work on less fuel than those in other countries where outside cylinders are the rule.

Weak Points in the Pooling of Locomotives.

A point made during the discussion about long runs for locomotives at the Traveling Engineers' convention was that it required a thorough organization of the shop force to inspect and take care of the engines at the terminals for long runs with a change of crews, just the same as it does for pooling engines, if you look for success for the plan.

There is no doubt that one of the gravest defects in a pooling system operated during a busy season only, is the want of a thorough inspection and maintenance of the engines at terminals. When each engineer had an engine assigned to him for regular hours, this work was attended to by the engineer, as far as reporting any defects, breakages or lost parts was to be taken into consideration. A sense of proprietorship spurred him on to look after its care, as well as the sense of responsibility for doing the work in a proper manner when on the road. It was also necessary for his own protection on the coming trip, and it was customary for the engineer on some roads to be allowed to specify just what work was most needed and what work could go for another trip.

Now, when the engine is double-crewed and goes right on through on a long run, or is in the pool, and sometimes before she comes in on one trip assigned to another crew, he does not have either time or opportunity to do much more than report on the condition of the engine while making the trip, before she is beyond his control. This takes from him any sense of responsibility he may have as to the future good service of a machine he may not have charge of for considerable time, may be months.

The roads that have got the best results from the pooling of engines recognize this vital point, and aim to treat the engines all the time from the standpoint of a machine which is got ready for the trip by one set of men and operated during the trip by another set, each having duties independent of the others. If it is supposed that the work of inspection and such work as has been done on the engines by the engineers while each man had a certain engine assigned to him, will be continued with the engines pooled, it will soon be found different. Where the men formerly sought opportunity to do this work, it is soon seen that the engines are taken from them before they have time to do it, and the certainty that they will surely have another engine next trip takes away any desire to do any work which is not specially paid for by the company—"that of keeping another man's engine in order," as it is sometimes called.

Bulletin orders from officers on this matter are grudgingly obeyed. The necessity of getting the engine out quickly for the train which many times is waiting for power is a good reason for neglecting it.

To pool engines and have them kept in good order so they will do good work, the engines must be kept in order by the shop force, and the men who operate them on the road make written reports, even if brief ones, about their condition on arrival.

The details of the engines which the engineer and fireman have to work with should be standardized as far as possible. One fault of pooled engines is that the little conveniences which an engineer likes to have about the engine are no longer there. He rides on a poor seat, if he has one at all; has no arm rests, or, in fact, anything to ease the shocks coming up into his body; no attention is paid to cab lights or the packing of glands and joints, and his first thought on stepping into a cab is not a pleasant one which will inspire him to give loyal service to his company.

It is the small annoyances that discredit the pooling business with the road men more than the greater troubles, and until an honest effort is made to make everything neat and comfortable for the enginemen, the same as with coach equipment, they will condemn it. A loss of loyal feeling among the men towards a company costs money, just the same as new engines.

Improving the Locomotive.

Perhaps it is because everybody from the mechanic to the hobo has a fairly close acquaintance with the locomotive that we find so many attempts to improve on it. At any rate it is certain that there are more laughable improvements suggested than in any other line, and it is certain that many of them are made by men with no idea of the locomotive or its requirements.

Among the recent patents we find a locomotive fitted with one smokestack outside the other, and also an air space between jacket and boiler. This was a down-draft engine, and all the air for the fire was to be drawn down the annular stack, be warmed around the boiler, and finally get under the grate, if it wasn't tired out.

Then we have a device for cleaning and drying the track—probably patented by a rival of the track sander manufacturers. This has coils of pipe in the firebox and in the front end, and a blower forces air through these and out pipes leading to rail in front of each wheel. The dirt is blown off, and the rail dried to produce maximum adhesion. Great scheme, of course!

Last of the trio we have seen within the month is a rotary engine applied to a locomotive. We have always been taught that the disadvantages of the ordinary or reciprocating engine were the difficulty of properly balancing drivers, and the dreadful hammer-blow which our friend Lockwood with his Shaw engine has worried about so much. This, however, seems to be a mistake, as this rotary is placed in the saddle in place of the cylinders, and the main rod and side rods are shown just the same. This indicates very plainly that the inventor has no idea as to objection of the present engine or the advantages of the rotary, and his patent fee represents so much money thrown away.

We might preach a little sermon on the patent attorney who will push these claims without first warning his client of its weakness, and we are sure a first-class patent lawyer will do this. But there is of course another side to the question, and as long as people will remain ignorant of the machines they attempt to improve, it is hardly worth while wasting pity over them. It would be a good plan for would-be inventors to take a course in a good correspondence school on the branch which they are endeavoring to improve, unless, of course, they are already well informed.

A very dangerous thing for trainmen is a badly fastened box-car door. Too little attention is bestowed upon having these doors so hung that they will not become loose and fall off or have the lower part slip out of its fastenings. When the latter happens the lower part of the door is frequently forced out by the wind so far that it strikes the engine or cars of a passing train. That is a part of the freight car which ought to be inspected very rigidly and frequently.

BOOK NOTICES.

"Small Engines and Boilers." By Egbert P. Watson. Published by D. Van Nostrand Company, New York. Price $1.25.

There is always something attractive about a little steam engine, and the ambitious young mechanic immediately wants something that can go. This book is written for just such cases and describes the building of small stationary engines having a practical value. With a small lathe and a work bench equipped with a vise, the engines described may be built by anyone having a taste for such matters. Parts are shown in detail, dimensions given, and in fact about all the instruction that can be given on paper is to be found here. The illustrations are clear, the book is well printed and bound, and can be recommended to anyone desiring information of this kind.

"The Cupola Furnace." By Edward Kirk. Published by Henry Carey Baird & Co., Philadelphia, Pa. Price $3.50.

The author, who is a well-known foundryman, has brought the practice of cupola melting up to date in this book, and it is safe to say no foundryman or one interested in the construction and management of the cupola can afford to be without this book. It deals with the construction of cupolas, tuyeres, management, melting, fluxing of iron, styles of cupolas, cupola records, and, in fact, about all the practical sides of the cupola question. The information is of a very practical character, dimensions and suggestions being given which are of great value. The illustrations are good and frequent enough to make the text perfectly clear. It has met with the approval of many practical foundrymen.

Stories of the Railroad.

Those who were accustomed to reading the *Locomotive Engineer* during the time this paper had that name and for the first few years of LOCOMOTIVE ENGINEERING, will remember the stories by John Alexander which appeared at intervals in the paper. They were exceedingly popular stories, and brought many friends to the paper.

The author of these stories was John A. Hill, then the junior partner of the firm of Sinclair & Hill. They have lately been collected into a volume and published by Doubleday & McClure Company, of New York; price $1.50. The volume contains nine stories, the best of those which Mr. Hill wrote. They are "An Engineer's Christmas Story," "The Clean Man and the Dirty Angels," "Jim Wainwright's Kid," "A Peg-legged Romance," "My Lady of the Eyes," "Some Freaks of Fate," "Mormon Joe, the Robber," "A Midsummer Night's Trip," "The Polar Zone."

Those who have not read the stories ought to lose no time in purchasing the book, and even those who have read them will find them very interesting to go over again.

The White Mail.

This is the latest book from the pen of the well-known railroad novelist Cy. Warman. When one begins to read the story, it looks as if Cy. had undertaken to write the "simple annals of the poor," for he lays the opening scenes in a remarkably poor neighborhood, and, as far as one can judge, among very unprepossessing material of the human kind. The scenes are in the neighborhood of Lick Skillet, an ague-haunted region of South Illinois, and his human characters are mostly trackmen and their families. From a small community, numbering twenty-seven, including "the nigger who drove Jim Anderson's bull team at the mill," two boys work their way forward to take a higher place in the railway world.

Tommy Maguire, while following the occupation of driving a mule for pumping water to the railroad tank, sees the bridge over the creek washed away one night, and he mounts his mule to flag the White Mail. The mail comes along at a breakneck pace as usual, but Tommy and the mule make a very good flag, which leads to a stoppage of the train on the brink of the flood. The incident ended the usefulness of the mule, but it led to Tommy's advancement to a position in the office of the general freight agent. One of the individuals of Lick Skillet has been promoted to the position of messenger in East St. Louis before Tommy's good fortune came upon him, and both the boys started out to enjoy juvenile life together. One of their first experiences, while hiding under a bridge, was to hear three train robbers scheming the holding up of one of the Vandalia trains. The boys gave the robbers away, and became heroes in consequence.

After a time Tommy Maguire went still farther West, to grow up with the prairies that the Union Pacific had just extended over. Tommy accepted a position as station agent and telegraph operator at a station in the wilderness, where he had no neighbors but prairie dogs, wolves and stray Indians. The book gives a very graphic account of a fight which Tommy carried on single handed with a band of Indians. That kind of life proved too monotonous at times and too exciting at others for Tommy's taste. He went still farther West and joined the Denver & Rio Grande. A considerable part of the book is devoted to describing the adventures of Tommy in Leadville and other parts of the Denver & Rio Grande. That is a strong line of writing for Cy. Warman, because he can easily draw on his own experience to describe what a hero of a novel is supposed to have seen and done.

While running as conductor of a pas-

senger train, Tommy succeeds in rescuing a lady passenger who had ventured out of the car when they were stalled in a snowstorm and got into a very perilous position. Tommy proves to be a pusher, and by degrees forces his way along until he reaches the position of general manager of the road. Meanwhile he had become smitten with the young lady that he rescued in the snow and was always thinking about her and hoping to meet her sometime. That comes along in due course, and she turns out to be the daughter of the biggest stockholder of the railroad, so when Tommy marries her he has reached almost the top of the heap, so far as railroading was concerned.

The book is published by Chas. Scribner & Sons, New York. In cloth, price $1.25.

Jim Skeevers' Object Lessons.

Although it is now more than two years ago since the last of "Jim Skeevers' Object Lesson" articles appeared in LOCOMOTIVE ENGINEERING, it is safe to say that all of our readers who were accustomed to reading them are still hoping that the author will resume his pen and give to the mechanical world more of the wit and wisdom for which the articles were noted. "Jim Skeevers' Object Lessons" were written by Mr. John A. Hill, who believed in giving instruction on the laws and principles of mechanics by means of stories. That line of instruction is much more impressive than merely discoursing on the subjects taken up, and it proved highly popular, and thousands of our readers learned valuable engineering facts through the object lessons who never would have had the patience to study the bare principles.

Mr. Hill has switched away from the life that brought him material for "Skeevers' Object Lessons," and he is not likely to write any more of them, but he has done the next best thing by collecting the best of the sketches and publishing them in book form. It is now ready, and is for sale in this office; price, $1.

"Skeevers' Object Lessons" ought to be read at least once a year by every ambitious railroad man. Those who have read them will enjoy thoroughly a second perusal, and the book keeps them in convenient shape; those who know them only by name ought to lose no time in sending for the book. We have frequently heard ladies say that they enjoyed reading Skeevers as much as the other sex did. To the ladies we would drop the hint that the book will make a most acceptable Christmas present.

To Extend the Usefulness of the Master Mechanics' Association.

In his inaugural address at the opening of the last convention of the American Railway Master Mechanics' Association, President Quayle recommended that something should be done to extend the usefulness of the association. This has now taken practical form in the appointment of a committee to investigate the subject and report at the next convention. The committee consists of Messrs. T. R. Browne, G. M. Basford and L. R. Pomeroy.

We hope that the committee will be able to suggest some practical plan for increasing the usefulness of the association, for it appears to be suffering from the work done by the various railroad clubs and other causes. In years gone by the reports and discussions at the Master Mechanics' conventions represented what may be called the authoritative opinion on all new and advanced ideas concerning locomotive construction and the best methods for operating and repairing the motive power at the least possible expense. The report of the proceedings was looked forward to by hundreds of master mechanics as a volume that would give them valuable guidance in discussing with their higher officers the line of improvements they ought to follow.

The establishment of railroad clubs has changed all this. As soon as any question of importance arises concerning railroad rolling stock, or other lines of railway machinery, the secretary of some railroad club pounces upon some member who is known to be familiar with the improvement or change contemplated, and he is influenced into preparing a paper fully ventilating the subject. That is read at the club and discussed by the members. If it proves of more than ordinary importance, other clubs take it up, and it is discussed threadbare before it comes before the Master Mechanics' or Master Car Builders' convention. The geographical space which they cover gives the railroad clubs a material advantage over the mechanical conventions that meet in practically the same region year after year. There are always some improvements and tests going on that have a local origin, and the men familiar with the particulars are able to attend some railroad club where reports are made on what is going on. In this way every advance and improvement is weighed, examined, and the light of experience thrown upon it long before the larger associations can do anything about it. And the worst of the matter is that the members of the railroad clubs act as if they did not care anything for the views of the national mechanical associations.

The Master Car Builders' Association and the Master Mechanics' Association are themselves to a great extent responsible for their loss of influence among railroad mechanical men. In the early days of the associations the policy was followed of holding the annual conventions at points where the greatest possible number of members could be brought to the meetings. Another consideration was to hold them in places where manufacturing plants containing processes in which the members were likely to be interested could be examined. Care was taken to spread the conventions over a wide geographical area, so that members unable to travel very long distances would have the opportunity of attending the convention when it was held not far away. Of late years the policy in this regard has been entirely changed. It has not been the convenience of the members that was a paramount consideration, but the sentiments of certain fashionable people, who used their influence to have the conventions held in a fashionable resort. Under this influence the conventions have swung between Saratoga and some other fashionable resort. The alleged reason for going to these places has been that they were the only ones that afford sufficient hotel accommodation. The theory is that the conventions must be held at a place where there is a single hotel large enough to accommodate the whole company. In practice the people always spread around into a variety of hotels that suit their tastes. The allegation that no place but Saratoga and Old Point Comfort has hotel accommodation sufficient for the conventions is all humbug.

One of the most successful conventions that the master mechanics held of late years was held in Boston in 1891. The headquarters were in a small hotel, but the people found all the accommodation they wanted, and there were remarkably few complaints. That was about the last time that the members of the association had the choosing of where they wanted to meet. About that time the choice fell into the hands of certain ladies, mostly the friends of the supply interests, and they have kept their hold ever since, and we do not see any indications of their relinquishing their grip. It is not the members of the associations who decide where next conventions shall be held, but the ladies whose friends sell supplies to railroad companies.

We do not feel inclined to dictate to the committee that is investigating how the usefulness of the Master Mechanics' Association can be increased, but we will venture on some suggestions. Urge that the conventions be held in places where members can attend who have never before had the opportunity of being at a meeting. Recommend Detroit, Chicago, Omaha, St. Paul, Kansas City, Denver and other railroad centers. Select headquarters at some hotel, and make arrangements with others to care for the balance. That may, to some extent, interfere with the social functions and there will be protests from the fashionable element. But the interests of the association will be promoted.

We send our Book of Books free on application. It is a great help to people looking for good reading matter. We procure any book asked for by any of our friends.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(98) W. A. B., Stamps, Ark., writes: Will the side rod on a three-wheel connected engine pound any more than a two-wheel engine? A.—Not necessarily.

(99) A. B. A., Pictou, Nova Scotia, writes:

Please let me know in November paper how to find the horse-power of any locomotive. A.—We have answered this question so often that we must be excused from giving it again at present. Full particulars are given in Sinclair's "Locomotive Engine Running," 1899 edition, page 313. It is also explained on page 31 of our January number.

(100) S. R. N., Chillicothe, Ohio, asks: If the lap on the valve is increased from ¾ inch to ⅞ is it necessary to increase the throw of the eccentric and give the valve more travel? A.—Yes. If the lap of the valve is increased its travel must be increased, if you expect to get a full steam port opening. This usually requires new cams of increased throw. The eccentric cams must also be set at a new position on the axle in relation to the crank pin in order to open the steam ports at the proper point of the stroke of the piston.

(101) M. B. G., Milwaukee, Wis., states:

With a double crewed engine each engineer fills his own lubricator. Some of us only use half a cupful, so we put that amount of oil in it. On starting out on the run the cup will not feed at first, although all the valves are opened properly. What is the trouble? A.—When you fill the oil tank half full of oil fill the rest of the space by pouring in water. If you do not have the oil tank full it must be filled from the condenser above it. That takes time, and the cup will not feed properly till the head of the water is high enough in the condenser to force the oil out through the feed nipples into the sight feed glasses.

(102) J. W. S., Live Oak, Fla., writes: I have an engine that exhausts square when the lever is in the corner each way, but when I pull the lever up it does not exhaust square either way; I mean in back or forward motion. I wish you would please tell me what is the matter with her and how to make her exhaust square when I pull the lever up. A.—That is a common valve motion disorder, but no remedy can be suggested without a careful examination of the motion. There is a distortion of some kind. It may be in the original planning of the motion, and it may be through some part or parts being sprung. A common practice with an engine of that kind is to set the valves so that the cut off is adjusted nearly true at the point where most of the work is done.

(103) R. A. M., Albany, N. Y., writes: There are three words that I meet with in articles relating to heat, of which I am a little uncertain as to the correct meaning. They are conduction, convection and radiation. Will you please give plain definitions of the words? A.—Conduction is the passage of heat through any body. When the sheets of a furnace are heated, conduction conveys the heat from the fire side to the water side of the sheets. Convection is the method by which heat is circulated in a fluid mass by the motion of the particles. It is by convection that the heat from a furnace is diffused through the whole body of a boiler. Radiation is another process by which heat is transferred. The heat from a clear incandescent fire is transferred to the furnace sheets by radiation. Radiant heat travels in straight lines, called rays.

(104) C. M., Wilkesbarre, writes:

I would like to ask a few questions. Is it wasteful to carry a steam pressure over 200 pounds? Will the engine develop more power? A friend of mine says no. We have some engines on our road that had 26-inch stroke by 20 inches diameter. We changed to 24-inch stroke, and engineers say they are better now; same steam pressure. Where does the gain come in? Is a longer stroke better on a hill, and why? A.—These questions indicate very conflicting opinions, but they are merely opinions with no tests to prove them. An engine carrying 200 pounds pressure, with 26-inch stroke, will do more work than one with 24-inch stroke, the wheel diameter of both being the same. But if the power is too great for the weight on drivers, the engine with the shorter stroke may work better than the other. Increase of boiler pressure and increase of cylinder capacity are always followed by increase of power, if the other proportions harmonize.

(105) C. M. G., E. Las Vegas, N. M., writes:

In looking over the August LOCOMOTIVE ENGINEERING I notice an article written by W. J. Murphy, giving the rules for firing on the Queen & Crescent Railway. On page 366 is found this paragraph: "It is beneficial to wet the coal before firing, and fireman should, as far as possible, use wet coal." I would like to ask why it is beneficial—i. e., do the gases of the coal combine with the water to form complete combustion? If there is a combination, will you please give the formula which represents it? A.—There is no economical advantage in firing with wet coal, unless it is so slack that when dry the greater part goes direct to the tubes before touching the burning fuel. In such a case the water will tend to hold it together until it reaches the fire. In ordinary firing, water in coal causes waste of heat, for the water must be evaporated before the fuel will burn, and heat is required to effect this evaporation.

(106) S. R. N., Chillicothe, Ohio, asks: What is meant by running the valves over by travel? A.—When a machinist sets the valves on a locomotive he calls the process of fixing the exact points of opening and closing the steam and exhaust ports, setting the valves. To find where these points are located the valves are "run over" to see what changes are necessary. After the changes are made in the motion work or eccentrics, an additional process is sometimes used, which consists in moving the engine slowly with her own steam and marking the valve stem with the tram point to show the exact travel of the valves and steam port openings. These marks can be compared for each end of the travel of the valve and for each side of the engine. If any inequality is shown it can be rectified before the engine is finally turned out for service.

The Pennsylvania Malleable Company.

The Pennsylvania Malleable Company have been organized, at Pittsburgh, and have commenced the erection of a plant at McKee's Rocks, in that city, for the manufacture of malleable castings from the smallest size up to the very largest. Contracts have been placed for the building of the entire plant, and it is expected to be ready for operation not later than the first of the year. The Pittsburgh Bridge Company have been awarded the contract for the main building, which will be 640 x 220 feet in size, and will be entirely of steel. It is to be completed in about three months. The site for the plant contains 10 acres, and adjoins the large works of the Pressed Steel Car Company, at McKee's Rocks. In addition to the main building there is to be a brick building, 60 x 100 feet, to be used as a pattern and carpenter shop, and another building of the same size and design, to be used for the storage of patterns. There will also be an office buiding, 40 x 60 feet in size. The temporary offices of the Pennsylvania Malleable Company are in the Park Building, Pittsburgh.

To the Sandy Ridge Fire Brick Company has been given a contract for 500,000 fire brick, to be used in the building of the annealing ovens and cupolas. The Root's Company, of Connorsville, Ind., have the contract for the blowers. The Auto-Gas Engine Company, of Chicago, have the contract for six gas engines of 65 horse-power each. The company are making a new departure in foundry practice in having all power generated by gas engines and electricity. The gas engines will operate the electrical generators to work the overhead cranes, the blowers, conveying machinery and other equipment. The plant will be thoroughly modern throughout, and will be splendidly equipped

for the manufacture of malleable iron castings.

The capital stock of the concern is $600,000, and is said to have been very largely oversubscribed. The greater part of the output will be taken by the Pressed Steel Car Company, whose large works are immediately adjacent. The officers of the Pennsylvania Malleable Company are as follows: S. White, president, and D. O. Holbrook, secretary and treasurer. Dr. R. G. G. Moldenke, for many years with the McConway-Torley Company, of Pittsburgh, and one of the best known foundrymen in the country, will be general superintendent.

Notes on the Great Eastern Railway of England.

The Great Eastern Railway Company operates some 1,200 miles of road with over 1,000 locomotives. The major portion of these engines is engaged in hauling passenger trains, the suburban service of this railway being the most extensive in Great Britain. A view of the rear of the principal engine shed at Stratford is shown in Fig. 1. The building has accommodation for eighty engines, which enter the shed and are marshalled in the order shown—tank engines for the suburban service on the right of the picture, goods engines on the center roads, and passenger express engines on the left. There are altogether 330 engines stationed at the Stratford depot. Roundhouses have no friends on the Great Eastern Railway, for with such accommodation it would be impossible to send out the engines fast enough, five, six, and even more, having often to leave at one time for the carriage sidings, shunting yards or London terminals. The turntable at the front end of the shed is operated by hydraulic power.

Extensive dormitories are provided above the shed offices for the lodging of drivers and firemen who come in from the country stations and have to take rest, recent legislation by Parliament having limited the hours of duty and rendered the establishment of such accommodation necessary. Mr. Holden, the locomotive superintendent of the Great Eastern Railway, has spared no pains in making these quarters comfortable and attractive to the men under his charge. A complete kitchen, with dining-room attached, is provided, as also are bath-rooms and smoking and reading rooms. Each man has a number given him on arrival, which corresponds with that of his cubicle, hat pegs, cupboard, etc., and particulars are taken by the attendant as to the time he requires his meals and has to resume duty.

Few railway companies can point to a better feeling between master and man than that pervading the working staff of the Great Eastern Railway, and to this desirable state of affairs many very valuable concessions on the part of the directors and a complete absence of "red tape" on the part of the higher officials have directly contributed. Every employé of the company, including the uniformed staff, is entitled to annual holidays, from three days upwards, at his full rate of pay, with a free pass for the transportation of himself, wife and family to and from any station on the system. This holiday, so far as the locomotive and car works shop staff is concerned, is made to run concurrent with the vacation at the time of the August bank holiday, special trains being then run on fast time for the conveyance of the workmen and their families from London to the chief seaside resorts of Eastern England. Privilege tickets are granted to the men of all grades as frequently as desired for themselves, wives and families for travel at one-quarter the ordinary rates.

FIG. 1.

Returning to the locomotives, all required for the Great Eastern system are now built under Mr. Holden's personal supervision and to his designs at the Stratford shops. The output may be put at 100 new locomotives per annum, when required, in addition to all repairs and renewals.

Oil fuel is extensively employed on the Great Eastern Railway, no less than forty-seven locomotives being fired, together with several stationary boilers and furnaces. Mr. Holden's patent apparatus for oil firing has been frequently mentioned in Lo-

COMOTIVE ENGINEERING, and the last engines built at Stratford to burn oil fuel were illustrated and described in the issue for August, 1898. They were designed for running the fast seaside express trains during the summer months, of which the Great Eastern Railway makes a specialty, and earned an excellent reputation last year. The oil tanks of the tenders carry 750 gallons of fuel, which is filled in through a manhole protected by a fine wire gauze strainer or sieve. From the tank the oil passes a tubular heater through which the exhaust steam from the air-brake pump circulates, and is here warmed to a temperature of about 200° F. before delivery to the burners. These latter are placed below the footboard of the engine, facing holes provided in the firebox front, about 12 inches above the grate bars. The oil is first sprayed into the furnace by an annular steam jet in the center of each burner, and then minutely atomized and distributed by small steam jets issuing from ring blowers placed immediately behind the nozzles. These also induce a considerable quantity of atmospheric air at the same time, and so insure good combustion. The first mentioned annular steam jet surrounds a central cone, which is in communication by piping with a series of heaters placed inside the smoke-box, and through these air is drawn and delivered to the burners at nearly 400° F.; this tends to dry the steam as it injects the oil, as well as raise the temperature of the combined spray.

Another type of oil-burning express engine with coupled drivers is shown in Fig. 2, of engine No. 712. This is one of a standard class, with cylinders 18 x 24 inches, and drivers 84 inches in diameter. The oil fuel is carried in two long cylindrical reservoirs laid along the top of the tender water tanks. Their combined capacity is 650 gallons. Broken firebrick is used to cover the grate when oil alone is being burned, and steam is raised with a wood and coal fire on a space raked clear for it. The engine can be fired with coal alone, coal and oil combined, or oil alone.

The oil fuel most generally used on the Great Eastern Railway is a mixture of coal gas tar and creosote oil, having a S. G. at 60° F. of 1.16, and a flash point of 230° F.; petroleum residues have, however, been used, and although the results have been superior to those obtained from the tar mixture, the supply of such products in England at present is not sufficiently organized to permit of it being used on a large scale for fuel.

The depot for storing oil fuel at Stratford has been specially designed for the purpose by Mr. Holden, with a view to the rapid receipt of the oil from the traveling tanks and its easy distribution to the engines. The oil tank wagons on arrival discharge their contents into underground reservoirs holding 50,000 gallons, and from these the oil is pumped by a small steam engine and rotary pump into the high-level cylindrical tanks, holding 40,000 gallons; from these the engines are supplied through two 4-inch standpipes. All the oil fuel used by engines in the London district is dealt with here, but for the outstations smaller depots have been put down at Ipswich and Norwich, where the engines fill their own tanks by air displacement. The hose pipe for the brakes is coupled to the underground reservoir and the engines then force the oil up into the tender tanks by pressure.

As an example of the latest engines built at Stratford, the photograph reproduced in Fig. 3 shows a four-coupled bogie tank engine, designed for suburban passenger service. The cylinders are 17 inches diameter by 24 inches stroke, and the drivers 59 inches diameter. The bogie wheels are 37 inches diameter and centered 5 feet apart. The boiler has a firebox with a grate area of 15.27 square feet and a total heating surface of 1,081.4 square feet. The weight in running order, with 1,000 gallons of water in the tanks and 2 tons of coal in the bunkers, is 52 tons. The engine is fitted with condensing arrangements for underground service, as the Great Eastern Railway trains enter the city below the surface.

All the carriages required for the line are built at Stratford, as well as the locomotives, and very extensive shops are continually engaged in the work. For comparison of the past and present passenger stock, the photograph (Fig. 4) of the old three-compartment, first-class carriage built in 1854 may be taken as a representative "old-timer." Its body was 17 feet 6 inches long by 6 feet high. For the modern specimen the engraving Fig. 5 of the dining-car train satisfactorily illustrates it. The accommodation here is for fifty-one third-class passengers and forty-two first-class. The length over the three cars is 130 feet, and the total weight, complete, 60 tons. The Great Eastern Railway was the first railway in England to provide dining accommodation *en route* for third-class passengers, and the service has become so popular that it is intended to considerably extend it during the coming summer [this letter was written in February last], four new, complete trains of long bogie cars being at present under construction.

At the Temple Mills shops, situated

FIG. 2.

about 1½ miles from Stratford, the freight equipment is produced and maintained, and a miscellaneous assortment of some of the latest productions emanating from these shops is shown in the photograph Fig. 6.

Refrigerator vans have been designed by Mr. Holden for carrying Italian butter from Harwich to London. The ice chambers are placed at each end, and the cold air circulates from the floor among the packages. The coal wagon standing next is of a standard type for the use of the locomotive department, and carries a load of 10 tons (2,240 pounds), while the adjoining water tank is precisely similar in both size and construction to those used for the transport of liquid fuel for the same department. A special wagon for the transport of large sheets of plate glass and two 20-ton machine trucks, with the 10-ton brake behind, complete the train. All, except the brake van, have steel underframes, for which Mr. Holden is a distinguished advocate, he having introduced them on the Great Eastern Railway system and provided new and efficient machinery for their quick and cheap production. At Temple Mills steel frames for the passenger cars, as well as the goods wagons, are constructed, the shops being laid out with a very extensive hydraulic system for pressing, bending and riveting them.

A. M. BELL.

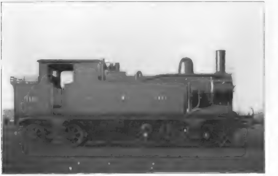


FIG. 3.

An accident happened to a train entering St. Enoch Station, Glasgow, of the Caledonian Railway, some time ago. The platform where the train was entering was partly blocked with empty carriages, and the train was not under sufficient control to stop without striking the obstruction. Owing to that accident the inspector of the Board of Trade has given orders that hand brakes alone be employed in stopping at terminal stations. Strange precaution against carelessness.

Instruction by Stereopticon.

During the Traveling Engineers' convention at Cincinnati Superintendent W. J. Murphy, of the Queen & Crescent route, gave a very interesting and instructive lecture on examination for keenness of vision and color sight, which was illustrated with stereopticon views. Two candidates were examined during the lecture, and a very significant idea of color blindness in railway service was given the members. The different colors were represented by views of a series of flags projected on the screen, and the candidate was then required to select flags of certain colors, and afterward pick out all the flags of the same colors shown. Views of semaphores of different kinds and in different positions were shown, and the surroundings would indicate the exact locality on the road, so this view served the same purpose as going out on the road to that point.

Mr. J. P. McCuen, superintendent of motive power, gave illustrations of the different kinds of break-downs on locomotives, all of which are used in examinations of firemen on machinery when they come up for promotion. A view is first shown of the engine after the break-down, and the candidate required to explain how he would block up and get ready to move the locomotive. After his explanation of this difficulty, one is shown him of another kind of break-down, and so on for all classes of break-downs. Views are also shown of the engines after being properly blocked up, which serve as object lessons for instruction purposes.

It is the purpose of Mr. Murphy to use the stereopticon method for all examinations, and it certainly is the best plan that can be used for the purpose.

The Illinois Central people are experimenting with what is known as the Sweney exhaust nozzle, which provides a series of oblong slots for the emission of steam from the exhaust pipe. The makers, who are the Root & Vandervoort Engineering Company, Champaign, Ill., claim that the nozzle opening is 20 per cent. larger than the ordinary nozzle. A performance sheet giving the comparative consumption of coal between an engine with the ordinary nozzle and that equipped with the Sweney seems to show a decided economy of fuel for the latter engine.

FIG. 4.

The cabs of the large Erie compound engines of the Atlantic type are now being fitted with steam heat pipes the same as the passenger cars. This timely and humane consideration of the engineer's comfort will be duly appreciated by those who have sat shivering and half-frozen for hours in a boiler-lagged cab.

Length of Rails.

The advantages of increasing the length of rails from about 20 feet to 30 feet, which may now be considered the standard length, were so obvious to everybody connected with the maintenance of track that it was not surprising when, about eight or ten years ago, an agitation began in favor of making rails 45, or even 60, feet long. The engineering department of several railroads indorsed the idea, and rolling mill companies were requested to roll rails 45 or 60 feet long. The experience with these long rails provides useful information for railroad companies that are willing to make a change of rail length, if the change is likely to pay. A committee of the Road Masters' Association was appointed a year ago to investigate the advantages of using long rails, and they reported at the convention held at Detroit last month.

The report cannot be regarded as favorable to increasing the length of the rail. The principal advantage to be gained from using rails longer than those now in use is to reduce the number of joints. In every other respect the inordinately long rail is a disadvantage. It is difficult to handle, and cannot be levelled true so easily as a shorter rail. Yet, strange to say, the principal objection urged against it by the committee was that rails of 45 or 60 feet are not properly straightened in the rolling mills, and in consequence of this defect cause much extra labor and annoyance. When complaints were made at the rolling mills the officials admitted that the long rails were not properly straightened, but that they could not help it. A more disingenuous reply would have been, "the appliances for straightening a 30-foot rail do not perform the work satisfactorily on a 60-foot rail, and the demand for the long rails is not sufficient to justify us in providing improved facilities."

The committee recommend that rails 33 feet long be adopted as the standard length. A change of that amount would be so trifling that it is not worth adopting. We suspect that most railroad companies will be contented to get along with the 30-foot rail, which has been found very satisfactory.

New Schedule on the Lackawanna.

Ever since the new management of the Delaware, Lackawanna & Western Railroad took hold, the sensational press has persistently circulated rumors that there was trouble between the trainmen and the company that was likely to lead to a strike or some other form of disagreement. We have always insisted that there was nothing in those rumors, and that the new management was determined to act fairly and justly to the man who was earning the wages paid to him. The system of paying men was quite antiquated, and while favoring some of the men, was very unjust to others. It was determined from the first to remedy this evil, even if it should cost the company a good deal of extra expense.

We are now informed that after protracted negotiations with representatives of the enginemen, conductors, brakemen and yardmen, a new schedule has been agreed upon, based upon mileage. Heretofore the trainmen on this road have been paid by the month or by the day. Under the new schedule passenger conductors running from 3,000 to 4,000 miles a month receive 2.33 cents a mile, baggagemen 1.23 and brakemen 1.17. Higher rates are paid to men running a less number of miles, and lower to those running more. Through freight conductors between Buffalo and Elmira receive 2.70 cents, and brakemen 1.80. On other divisions the rates are higher. The rates for enginemen and firemen appear to be the same on all divisions of the road, and there is only one rate for each class of service. Passenger enginemen receive 3.35 cents, freight 3.85, "consolidated trains" 4 cents, switching engines 3.25. Firemen, passenger, 2 cents; freight, 2.30; consolidated, 2.40; switching, 1.95. The schedule has the usual stipulations about minimum hours, minimum mileage to be allowed for short runs, overtime, etc. A temporary vacancy in passenger service of more than thirty days is to be filled by the senior freight man, if competent; less than thirty days, by the first man out who is competent. For every two brakemen promoted one conductor may be hired, provided there is no competent brakeman in the service of ten years' experience.

FIG. 5.

FIG. 6.

The Walworth Manufacturing Company announce their removal to their new store, 130-132-134-136 Federal street, Boston, Mass., on or before December 1st. They will be but a short distance from the new South Union Station, and can be easily reached from the North Union Station by cars direct to store.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Handling Air-Brake Trains.

Limited space and late arrival of matter prevented the following from appearing in our last issue:

The committee of the Traveling Engineers' Association on the question of "Proper Care of the Air Pump and Engineer's Valve While in Service, and What Is Essential to the Successful Handling of Air-Brake Trains," made a long report on this matter. It recommended the use of an independent driver brake with long trains, which brought out a spirited discussion from the members.

A variety of devices were recommended by the members. Most of these would be called independent releases, instead of independent brakes.

Mr. Miller, of the Cincinnati, Hamilton & Dayton Railway, stated that they used an independent release for the driver brake, a common one, which consists of a bleed cock for the auxiliary reservoir located in the cab, where it can be easily reached. This device has the advantage of notifying you at any time it is left open.

Mr. F. B. Farmer favored a cut-out cock between the triple valve and cylinder, which can be closed if you wish the brake held applied; or in other position a bleed-hole in the side of the cock will allow the air to escape from the cylinder without passing through the triple. This device has the advantage of allowing the auxiliary reservoir to be recharged every time the train brake is released.

Mr. Kidder spoke against cutting out the triple valve on the leading engine of a double-header at any time. In case there was danger from the two engines uncoupling or breaking apart and running together, the couplings between the two engines should be made more secure instead of avoiding that evil by cutting out brakes.

Mr. Wallace, of the Chicago & North Western, stated that they used all brakes and kept them in good order, and did not believe in having any extra handles or cut-out cocks.

Mr. Huntley, of the Chesapeake & Ohio, stated that they used pressure retainers on driver brakes, which could be set to hold the driver brake when the train brake was released. This prevented the slack running out of the train either on hills or at water-tank stops.

Mr. Gray, of the Santa Fé Pacific Railway, said that the retaining valve furnished by the air-brake company did a great deal better work than having the hand brakes set. It holds the train better on hills, has no ill effects on the wheels, and is in every way an advantage. Mr. R. D. Davis stated the same for the Illinois Central.

Mr. Hutchins, of the Westinghouse Brake Company, brought up the point in regard to the use of hand brakes on air-braked cars in preference to retaining valves; that with hand brake set the push rod was drawn out of the piston sleeve; when the air brake is set the end of the push rod is struck very hard. This is liable to damage the piston and disable that brake.

Mr. I. H. Brown, of the Westinghouse Brake Company saw no objection to the use of the retaining valve to hold the slack bunched at water-tank stops, etc., on level roads. He suggested the term "permissive driver brake," instead of independent driver brake. With large main reservoirs for long trains, there was no trouble from stuck brakes after a light reduction; with small main reservoirs there was trouble.

Mr. Hutchins spoke in favor of the use of a limited amount of cylinder oil in the air end of the pump instead of engine oil. With a good swab on the piston rod, oil and water would work down the rod and assist in oiling the air piston. Mr. Steele opposed the use of very much oil in the air end.

The question came up of releasing a few of the brakes on a long train at a slow speed—what is commonly called "kicking off" the head brakes. This practice was very properly condemned by nearly all present, as liable to break the train in two parts and cause slid-flat wheels on the cars on which the brakes had not kicked off.

When any of the brakes are to be released, it was thought better to release all of them and then make a second application. This brought up the question of using two applications for passenger-train stops. It was very fully discussed and favored by Messrs. Hutchins, Brown, R. D. Davis, Steele, F. B. Farmer and others. President McBain stated that they tried to make all stops with one application, with very good results.

Mr. Farmer presented a resolution that, "With all air freight trains of any considerable length, it is dangerous to release the brakes partially, but with passenger trains two applications are desirable." This was adopted.

In connection with this subject of two applications, it was noted that members whose territory is in a muddy country were obliged to make two applications to avoid sliding wheels; while, in a sandy country, with only one application, there was little or no trouble.

Brake Power on Passenger Trains.

A correspondent, in this department this month, justly condemns the lax maintenance of passenger train brakes on some roads and the failure to more generally use the high-speed brake on fast trains. He errs, however, in advancing his opinion that the car is robbed of much braking power through "extraordinary losses in levers, brake-rods and method of supporting the brakes."

All air-brake and car men are aware that the total force exerted on the face of the brake piston is not finally delivered to the shoes, and know that a considerable portion of it is absorbed in friction and work in transmission through the brake rigging. This absorption of energy, although a loss, does not rob the car of needed braking power, for the pressure delivered at the brake shoes has been found and been fixed by practice to give the highest braking power possible without sliding wheels. In other words, the considerable loss of energy in transmission from the piston to the brake shoes is known, recognized and provided for by employing a piston pressure which, when transmitted to the brake shoes, will give as much braking force as the wheels can stand without skidding. Even if these losses were prevented, no more braking power could be applied at the shoes.

Sufficient attention is not given to the proper hanging of the brake beams, so that the force delivered at the brake shoes may be used to the best advantage in train-stopping. Particularly is this true where short wheel-base trucks are used and where the hanger is made very short, thus causing the hanger to make either an obtuse or acute angle with a line passing through the center of the brake shoe and the center of the wheel, instead of a right angle, as it should. This discrepancy, however, is disappearing as the old, short wheel-base truck is passing out, and more attention is being paid to the really mechanical method of brake-beam suspension, as introduced and promoted by Mr. R. A. Parke, in a paper before the New York Railroad Club two or three years ago, and commented upon at that time in these columns.

That the 10-inch cylinder is not large enough for the heavier cars, as our correspondent asserts, is only too well known to all air-brake men who have had to do with figuring the leverage and equipping heavy cars with foundation brake gear. And although the tilting of the truck at the end of the stop is objectionable on account of the lurch it gives to passengers, it is not a prime factor in "cylinder losses

due to the truck trying to turn somersaults." This "cylinder loss" is much more largely due to the lost motion in the brake rigging, center bearing, pedestal jaws, boxes and brasses of the truck; and to eliminate it is impracticable.

The "Left-Hand" 9½-Inch Air Pump.

The demand of the railroads for an air pump suitable to go on the left-hand side of the engine has been met by the Westinghouse Air Brake Company, which is now making what is known as their "Left-Hand" 9½-inch air pump.

Having in view the necessity for making this pump interchangeable with the standard 9½-inch air pump, the steam and exhaust ports of the latter have simply been extended to new openings in which the standard steam pipe and exhaust pipe connections are shown located in the accompanying cut, at *A* and *B* respectively, while the corresponding ports *C* and *D* of the standard pump are shown plugged. If required, this pump can be substituted for a standard 9½-inch air pump on the right side of the engine, by removing connections *A* and *B* and transferring them to openings *C* and *D*, and the plugs removed therefromtransferred to openings *A* and *B*.

For the "Left-Hand" pump an extra drain cock is necessary for draining any accumulation of water in port *A*.

It was not considered desirable or necessary to make corresponding changes in the construction of the air cylinder, as the main air reservoir is quite as frequently placed forward as aft of the locomotive; and it is not inconvenient to shape the air delivery pipe thereto to suit existing conditions.

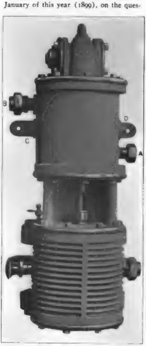
Russian Contract for Westinghouse Air Brakes.

A contract for American apparatus, amounting to $15,000,000, could not fail to absorb a good deal of public attention. The fact that the Imperial Russian Government was one of the contracting parties and the apparatus was such a purely American invention as is the Westinghouse air brake, were further factors in securing notoriety. Mixed with a feeling of national pride that American mechanism should be considered superior to all others, there arose also a spice of envy among competitors, which led to statements in the public press contradicting the exclusive nature of the Russian contract with the Westinghouse Brake Company.

The controversy has now been entirely set at rest by an important communication transmitted by Consul-General Holloway, of St. Petersburg, under date July 27, 1899. This communication fully confirms the exclusive nature of the contract for air brakes granted by the Imperial Russian Government to the Westinghouse Brake Company, and completely confirms every statement which the latter have given to the press from time to time. The order issued by the Russian Minister of Ways of Communication states:

Article 1.—In virtue of the opinion of the State Council, recorded on the 30th of March, 1898, imperially sanctioned, continuous automatic brakes are to be applied to the engines and trucks of the freight stock circulating in direct traffic on the Russian system of normal 5-foot gage railroads.

Article 2.—In conformity with the decision of the Minister of Ways of Communication and of the extraordinary congress of representatives of the service of rolling stock and traction, summoned in January of this year (1899), on the question of the choice of the fundamental system of continuous automatic brakes for freight trains, the Westinghouse system of brakes is adopted.



LEFT-HAND 9½-INCH AIR PUMP.

The Westinghouse air brake has been a potent factor in fostering railway traffic in the United States. It has enabled heavier and longer trains to be operated, and a more frequent service maintained. The Westinghouse type of air brake has been tried for so many years that it has the prestige of long successful operation. On this account it was decided to employ it exclusively upon the rolling stock of the Government lines, as well as upon private railways in Russia.

Article 3.—The order issued by the Minister of Ways of Communication admits the experimental introduction of other systems of continuous automatic brakes under certain stringent conditions, but excludes their general use until the expiration of the present Westinghouse contract in 1903. The conditions are as follows: (a) The previous trial of the new system on trains of local circulation, during not less than three years, for its thorough trial under the ordinary conditions of working; (b) the possibility of the combined action of the new system with Westinghouse's system; (c) the mutual interchangeability of the connections (couplings); (d) previous to the introduction of the new system into direct communication, the question of its practical suitability for this object is to be considered by the congress of representatives of the service of rolling stock and traction, and the ratification of the conclusion of the congress is to follow the usual course.

It is well known among railroad experts that trains made up of cars carrying different systems of brakes are often endangered thereby. The compressed air used in connection with the brakes is a very powerful force, requiring the greatest care in manipulation. To control the energy of steam driven trains, a higher force than could be produced by manual effort became necessary, and this was found in compressed air. The controlling apparatus in the hands of the locomotive engineer is necessarily of a very sensitive nature, and is capable of use in various degrees. The quick-action brake is employed on ordinary occasions for stopping trains, but by a further turn of the lever the same apparatus causes the emergency brake to be put into operation, applying the full energy of the compressed air. It may, therefore, be easily understood that trains made up of cars carrying different types of brakes may be seriously imperilled, since some of the brakes will not respond as quickly as others to the control of the engineer. In fact, several railway accidents have been traced to this very cause.

The Imperial Russian order involves the equipment of 300,000 freight cars, as well as a large number of locomotives. Sixty thousand cars are to be fitted with Westinghouse air brakes, and the remaining 240,000 with air pipes and couplings, inside of three years. The decree stipulates that 20 per cent. of the freight cars of a train shall be equipped with air brakes, all of which will be capable of control by the locomotive engineer, as the air pipes and couplings will be continuous throughout each train.

One of the stipulations made by the Russian Government is for the manufacture of the air brakes in Russia. For this purpose the Westinghouse Company have erected a fine plant at St. Petersburg, equipped with the latest improved Amer-

ican machinery, and is now employing a large force under expert American engineers. The general manager is Mr. A. Kapteyn, of London, who is assisted by Mr. Walter Phillips, of Philadelphia, and by American experts in charge of the various departments.

Consul-General Holloway, of St. Petersburg, writes:

"Russia is the first country in Europe to use the continuous air brake for its freight and military trains. While Russia began the development of its industrial resources much later than other nations, she is pursuing the policy of equipping her new factories with the latest modern machinery and adopting the most perfect methods of manufacture, as shown by the many new industrial plants in course of construction, which are almost without exception among the finest to be found in Europe. These are being assisted by the enterprise of Americans, who are beginning to appreciate and take advantage of the opportunities offered by this country."

In order to meet the requirements of the Russian railways, the Westinghouse Company have decided to double the original size of their works in St. Petersburg. It is intended, as soon as the brakes can be manufactured, to apply them to all the freight cars on the Imperial and private railroads, the present arrangement for 20 per cent. of each train being but preliminary to their universal application.

9½-INCH AIR PUMP AT CORNELL UNIVERSITY RIGGED UP TO TEST EFFICIENCY OF A WATER JACKET ON THE AIR CYLINDER.

CORRESPONDENCE.

Wear of Triple Valve Piston Packing Rings.

Editor:

There seems to me to be a time near at hand when a new problem will be presented for solution to air-brake men. I refer to the wear of the packing ring in the triple-valve piston.

Heretofore this packing ring has been given some little attention by air-brake repair men in overhauling the triple valve. To make myself clearer, I would say that the packing ring has been considered only when the whole triple was being repaired. The packing ring was repaired because the other parts of the triple were being put in good shape, and it was desired in overhauling the triple that all parts should be given attention. Hence the packing ring was repaired along with the other parts, in order that the repaired valve might go out completely overhauled as a whole.

The problem I refer to is that of looking after the good order of the ring itself, without consideration of the triple valve as a whole. Now that our freight trains frequently reach a length of fifty, and even seventy, cars, it becomes imperative that the piston packing ring shall be kept in perfect repair—much better than was given it when trains were shorter. For now a badly-worn or ill-fitted packing ring means the failure of the triple to respond to light reductions and increases of pressure in the train pipe. This failure to respond means a failure to apply and release in unison with the other brakes, and means that slid-flat wheels and break-in-twos will result therefrom.

Those who have visited the works of the air-brake manufacturer have observed the care and detail with which these rings are fitted, and will recognize the fact that the manufacturer has anticipated, and even foreseen, the conditions to which I refer. He has even provided for it, as far as is in his power, by making as perfect a fit of the ring in its piston and cylinder as human skill and most modern machinery can do it.

I was surprised to learn on one of my trips to the manufacturer's works that a perfectly round hole could not be bored on a lathe—it being necessary to afterwards place the triple on a small boring mill and bore out with rapidly revolving emery wheels the triple valve bush in which the piston works. In this way only, I learned, could the bush be made perfectly true. Although I was impressed at that time with the care taken to procure a perfect fit, I inclined to the belief that such refinement in fit was hardly necessary; but now, in the day of long trains, I can appreciate such necessity, and see the foresight and wisdom of the manufacturer.

Now comes an important part of my discussion. We must admit that the fit cannot be made too accurate, and that the small excess pressure in train pipe pres-

sure to release brakes, particularly on rear cars of a long train, demands this refined fitting. But how many railroads can be brought to see the necessity for such perfect fit? And how many will take the trouble to make such repairs? How many shop men still think that they, with their fairly good machines, can bore a hole perfectly round—a thing the manufacturer admits cannot be done except where special emery-wheel boring machines are used. Again, how many railroads, in attempting to fit packing rings in the triple-valve piston, grind them rapidly for a long time in oil, until the full ring and cylinder walls have a perfect bearing? Not many accomplish it, I venture to say, although many attempt it.

I have seen many rings turned out by repair men in a railroad shop where the ring had a bearing only at the ends and the opposite side, fitting poorly together at the ends and gaping after grinding. This kind of repairing has existed for some time past, and as short trains hid it, the defective work passed undiscovered. But it is now, in the time of long trains, that the defects are beginning to show up and demand better and more accurate work.

To the writer's way of thinking, it would be much better with the large number of brakes now in use, to send in groups, and by systematic process, the triple valves to the manufacturer, who, I understand, is now repairing triples by replacing all the wearing parts with new and newly fitted pieces—leaving no old parts but the case, etc.—at a cost little above the amount now being spent by railways to reseat the slide valve and put in a poorly fitted packing ring, little, if any, better than the old one removed. This really gives a new triple valve for the price paid for repairing one. AMOS JUDD.

Boston, Mass.

A Metal Packing for Driver Brake Cylinders.

Editor:

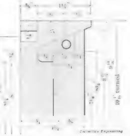
I send you herewith a drawing of a brake cylinder packing designed by myself, with a few words in explanation.

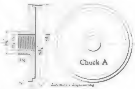
Those on whom the duty devolves of maintaining air brakes to their highest efficiency realize the almost hopeless task with the ordinary leather packing, and especially with driver brakes. In speaking of the highest efficiency, it is not sufficient that the brake will remain set, or, in other words, that the piston will stay out a certain length of time. The vital point is, "How much pressure are you maintaining in the cylinder?" The veriest novice should know that the pressure alone is what makes the brake effective.

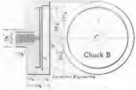
Our air-brake inspector has set the test for driver brakes to a leakage limit of 10 pounds in five minutes. On the face of it, it does not seem a difficult matter to come well within this limit; but let the uninitiated place a gage on the ordinary driver-brake cylinder, and with watch in hand note the rapid fall in pressure. It is like the last breath of a departing loved one all too soon, or the rapid melting of a ten-dollar bill when once broken.

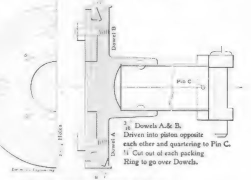
In line with other improvements, we have adopted the semaphore gage and made excellent use of the old duplex, by piping the red hand to the air signal and the black hand to the driver-brake cylinders. This arrangement gives a constant test, and I believe an aid to the proper maintenance, far outweighing the cost of another gage. By this arrangement, the slightest defect in the action of either signal or brakes is noted at once. But what a tale it tells of the beforetime good push-down or push-out brakes; and what a story it would tell of the old pull-ups, that usually will not hold corn in the ear. (We haven't any of this latter class.) It is giving to the roundhouse foreman that stoop shouldered, preoccupied air born of carrying great loads of responsibility, trying to keep within the leakage limit.

As a panacea for these ills, we have evolved a metal packing as per sketch. It is not patented, but is rather an improvement on the Ramsdell packing. A reference to the sketch should be sufficient to show the working principle. The effort of the rings in trying to pass the piston makes a tight joint, providing the workmanship is perfect. To this end, it will be found necessary, in almost every case, to rebore the cylinders, even those just from the manufacturers, and in making the rings we find a special chuck indispensable. The rings are first made from an ordinary blank, then placed on the chuck or mandrel *A*, faced and ground together, then driven into the chuck *B*, the taper turned and ground to piston in the lathe. The false plate is to facilitate removal of rings. The rings are turned with no tension, and depend entirely on the action of the air to set. This allows a free release.









IMPROVED PACKING AND METHOD OF MAKING.

The follower should seat home on the head and hold the rings close, but not to bind. The rings are doweled to piston head to allow them to turn with the piston, which, by the way, should be turned in the cylinder once a week or oftener, to insure good lubrication in horizontal cylinder, but need never be done with a perpendicular.

With this arrangement we have no diffi-

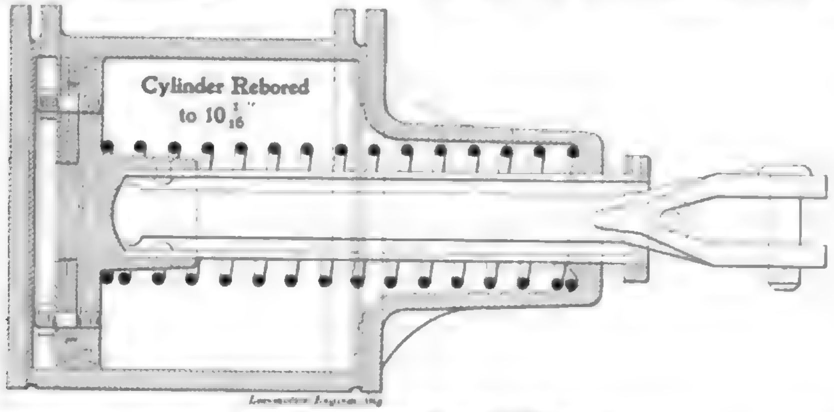
culty in coming well within the test limit in service, while in the shop we can retain the pressure for an hour or more. The cost is about $6 per engine, and should, with ordinary care, last for years.

H. N. WEBBER,
Gen. Foreman, Maine Central R. R.
Waterville, Me.

Braking Power on Passenger Trains.

Editor:

In the Air-Brake Department of your October issue is an article entitled "More Brake Power Needed," and although the article covers the ground very carefully, yet I cannot agree with the article, because the evidence that we have is contrary to the facts stated.



REBORED CYLINDER, WITH NEW RING.

Last week there were five accidents to passenger trains on five of the leading trunk lines. Not one of these trains was high speed, yet nine locomotives, eight coaches and twenty freight cars were wrecked.

There is power enough to-day if that power was delivered at the wheels, without the extraordinary losses in levers, brake rods and the methods of supporting the brakes.

Though wonderful progress has been made in the car body, so that many of them deserve the title of "rolling palaces," yet the vital and most important part of the coach has not been altered or improved in the last fifty years!

On looking through "The World's Rail Way," we find the passenger-car trucks of to-day and those of fifty years ago, in principle, are the same, and it does not require more than the average intelligence to prove that what was good enough in principle fifty years ago is not proper and suitable for present service.

It is scandalous, the condition of the trucks and brake rigging of even so-called "finest trains in the world," and the wonder is there are not more accidents.

Let any man take his stand at a railroad depot and watch a heavy train draw into it at a high speed, and he will notice whether the trucks are four-wheeled or six-wheeled, they are all on end; that when the shoes are released, they stand from ½ to 1 inch from the wheels, and that there is a general lack of care shown in not only design, but in maintaining this part of the train. The 10-inch cylinder will provide power enough for any train in America if the brake mechanism is properly designed, so that when the piston passes the leakage groove, the shoes will take hold of the wheels, and the truck frames will maintain a horizontal position so that there will be no cylinder losses due to the trucks trying to turn somersaults.

Let us have an improvement along this line and we will hear of fewer accidents.

JOHN HECTOR GRAHAM, M. E.
Boston, Mass.

[While we agree with our correspondent in that part of his communication referring to the lack of proper care of air brakes on many high-speed trains, and the necessity for high-speed brakes, yet we must differ with him when he makes the remarkable statement that "the 10-inch brake cylinder will provide enough power for any train in America," and when he refers to the effect of "the extraordinary losses in levers, brake rods and the methods of supporting the brakes." See editorial on this subject elsewhere in this department.—Ed.]

There was a time when it was highly important to have the air pump on the right-hand side of the engine, within sight and easy reach of the engineer. That was in the early days of the air brake when it was a common thing for the pump to stop and have to be coaxed into action again with the persuasive soft hammer. But now, when time and experience have so perfected the pump, these troubles have disappeared, and the demand for an unobstructed view ahead of a swiftly flying train has forced the pump to the left-hand side.

Train men in pulling the air-signalling cord should know and bear in mind that the longer and more savage pulls do not give any better, or even as good, signals as a sharp pull of one second, allowing two seconds between pulls. Not only is this true, but the signal is spoiled by such senseless pulling for immediate subsequent signals.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(72) S. M. R., Buffalo, N. Y., writes: If the train pipe on the fifth car of a nine-car passenger train is broken so badly that it can't be plugged or mended, what would you do? A.—Switch the car behind, couple up the hose and open the rear angle cock on the next to the last car, keeping the head angle cock on the rear car closed. If the rear car should break off, the air brakes on the eight head cars will apply and the train be stopped.

(73) J. R. L., Lansing, Mich., writes: Why is the air cylinder of the 9½-inch pump now made with ribs on the outside? I can see that leaving the lagging and jacket off will make the pump run cooler. But why are the ribs put on? A.—The ribs present a larger total area for the heat, generated in pumping, to radiate and dissipate itself, thereby keeping the cylinder, and consequently the air, much cooler. The jacket was formerly put on for the sake of appearances only.

(74) A. J. P., Youngstown, O., writes: If I have fifty cars in my train, and the same is leaking pretty badly, which is the best thing to do, cut off twenty-five of them and use the head twenty-five, or cut out every other car and use the whole fifty? A.—Neither way is correct. Keep all cars cut in and working, carrying a lower pressure, but as high as you can without overheating your air pump. It is harder on a pump to pump against leakage at a high pressure on a few cars than to pump against twice as many at a lower pressure. The train will also be stopped quicker, and will be smoother handled.

(75) J. R. L., Lansing, Mich., writes: I find that some of the cars going through here have got their leakage grooves in the side of the brake cylinder instead of the top. This is different from most cars. Why is it done? A.—In order to get the air brake on some of the hopper bottom coal and ore cars it is necessary to locate the cylinder on top of the sills, in the unused space at the end, near the hand brake. This places the cylinder upside down, and were the groove cut in the top side, as usual, it would be on the bottom in this case, and would clog up. Hence it is cut in the side now, and suits all cases.

(76) H. L. H., Pensacola, Fla., writes: We have an engine equipped with a No. 1 duplex pump that has been giving considerable trouble by running hot. On examining it, I found the piston heads and packing rings to fit nicely in the air cylinders. Air valves had their proper lift, 1-16 all around, and air passages were clear. Also discharge pipe to reservoir. As an experiment, I increased the lift of the air valves 1-32 inch, making 3-32 inch in all, and since then have had very satisfactory results. Was this correct? Please explain. A.—We can see no objection to your changing, particularly as you claim

beneficial results. The lift was probably insufficient until you increased it, thereby giving larger passageway for air.

(77) M. R. B., Louisville, Ky., writes: We have been experimenting with graphite in place of oil, and in some cases we have got good results and in most others the results are not so good. Why is this? Please explain. A.—You do not say where you have had good results and where poor results. It should be borne in mind that graphite is not a competitor of oil and grease in air-brake service, except where decrease of friction is desired. In nearly all parts of the air brake oil or grease serves a double purpose by decreasing friction and making an airtight joint, as in a brake cylinder, for example. The same is true of the triple valve piston, slide valve, equalizing piston and rotary valve. Graphite alone in any of these parts would be a failure, as it would be in the air cylinder of the pump, where it deposits, becomes hard and restricts the air passages.

(78) D. B. S., Murphysboro, Ill., writes:

I have heard it said that the air brake company is not in favor of the automatic driver brake release valve. Could you please state their reasons, if you know of any? A.—We are not clear on what you mean by the "automatic driver brake release valve," but assume you refer to the special valve sometimes used on switch engines, and which is placed in the pipe between the triple and brake cylinder, so the brake cylinder pressure can be released quickly and without passing back through the triple valve. This form of valve is used on some switch engines having large brake cylinders and old plain triples, which make the release too slow for quick switching work in the yard. In road work this quick release is avoided rather than sought. A slower release is desired, as the slack of the train is thereby better controlled, and break-in-twos are less likely to happen.

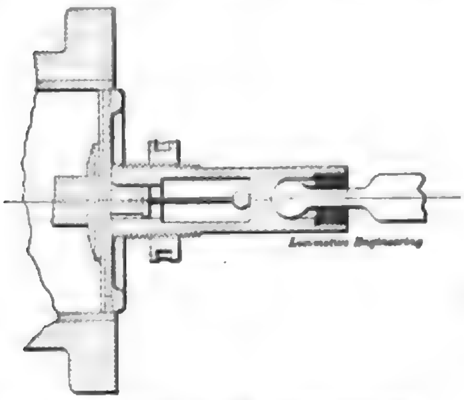


FIG. 4. TRIPLE PISTON RING GRINDING MACHINE.

"Independent driver brake" is a phrase which should be forever struck from the air-brake man's vocabulary. It was born in the old days when the practice existed on some roads to have the driver brake separate from the train brakes, and to have it apply and release "independent," with no regard to the other brakes. This practice has passed out, and the phrase belonging to it should go with it. Experience has decreed that locomotive and train brakes shall act continuously; but if good practice should require a supplementary device to assist the driver brake in retaining or releasing its pressure at the option of the engineer, that device should be called a fitting name, possibly "optional retaining and release valve;" but never "independent driver brake."

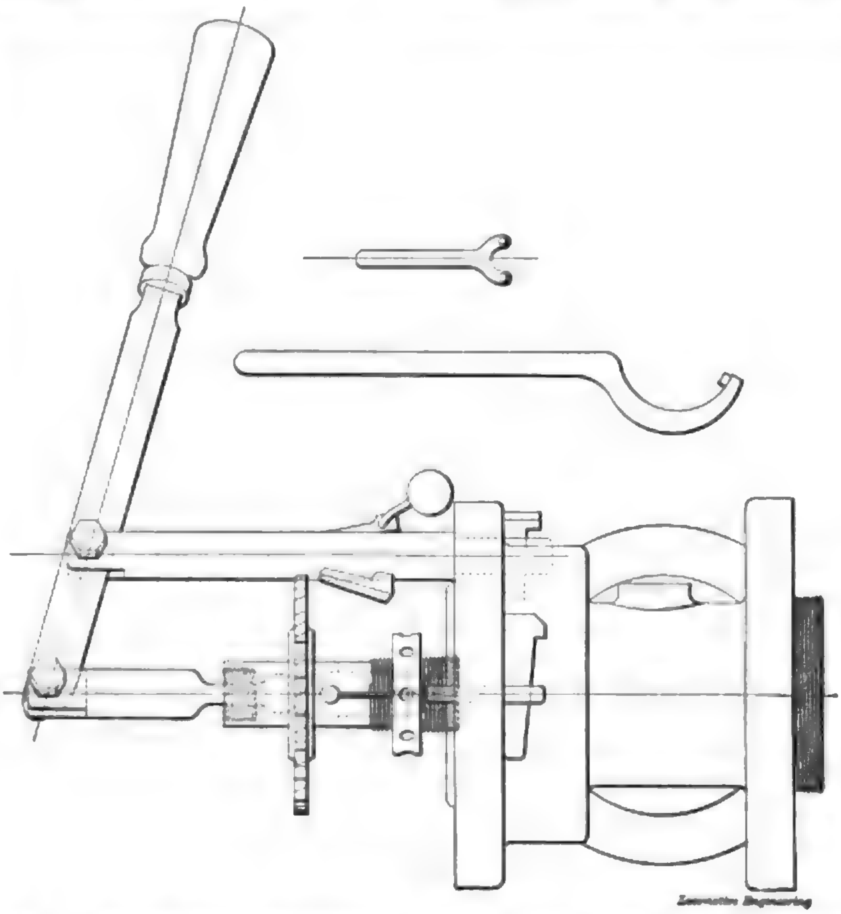


FIG. 1. TOP VIEW OF DEVICE FOR GRINDING PISTON RINGS IN TRIPLE VALVES, USED ON THE ST. LOUIS & SAN FRANCISCO RAILROAD AND DESIGNED BY J. N. MAKLEY.

One of the interesting features of the contract giving the sweeping and exclusive concession of the Russian Imperial Government to the Westinghouse Air Brake Company to furnish air brakes to be used on the locomotives, tenders, passenger and freight cars of all railroads in the empire, is that an "instruction carriage" fitted up with necessary apparatus and manned by competent instructors shall be furnished by the brake company and placed at the disposal of the State railways.

An interesting coincidence in this department this month is our publication of a triple valve piston ring grinding machine, and the publication of a letter from a correspondent who questions the ability and advisability of railroad shops doing this work. Note both carefully.

The testing of a driver brake by coupling an air gage to it will, in most cases, reveal a misplaced confidence in the supposed good work the brake has been doing. The gage test is the only reliable test. A correspondent truly states the case when he says the question is not how long the piston stays out, but how much pressure is being maintained in the cylinder.

Quite a number of the railroads are now placing the air pump on the left-hand side of the locomotive; and some roads have given orders that all pumps bought in the future must be suited to go on the left-hand side.

A handsome and deserved compliment was paid the Westinghouse air brake by the Russian Congress of Rolling Stock and Traction, which said: "The Westinghouse air brake has been a potent factor in fostering railway traffic in the United States. It has enabled heavier and longer trains to be operated, and a more frequent service maintained." This, being true and coming from a body of observing foreigners, is a high tribute to an American invention.

The Black Smoke Problem.

At the last meeting of the Western Railway Club, on October 17th, a paper was read by Arthur R. Reynolds, M. D., Commissioner of Health, Chicago, on "The Smoke Nuisance and the Abatement Thereof," and one by John C. Schubert, chief smoke inspector of Chicago, of the same tenor.

Dr. Reynolds said that there had been a great improvement in the last few years, which went to show that an honest effort was being made, that some stationary plants were smokeless, that while the railroad companies should take the public more into its confidence and give a valid reason, if there is one, why locomotives should smoke at all. He suggested that the president of the club select a committee of competent men from among the members to pass upon the whole question of fuel combustion by locomotives and make a report giving a resumé of what is known on the subject, what can be done, what cannot be done, and reasons why. He propounded twelve questions on the matter, as follows:

1. What are the differences between the various grades of coal on the market, both as to their power-producing units and their ability to burn without smoke? At what cost can they be utilized in a smokeless manner?

2. What conditions and capacity of grate surface, compared with the boiler capacity, have been shown to produce the most perfect combustion with the ordinary grades of bituminous coal? The term perfect combustion is used on the assumption that where it is obtained there will be no smoke.

3. What are so-called smoke-prevention devices, and what are their limitations?

4. What changes, if any, are required in the engines now in use in Chicago?

5. What sized trains, either empty or loaded, may be hauled by an engine of a given boiler capacity without making smoke?

6. Is it practicable for the railroad companies to operate trains within the city limits without taxing their engines beyond their capacity to do their work without making smoke?

7. What part does careful and scientific firing play? and is it possible to secure and retain a competent fireman?

8. Is the examination and licensing of firemen and engineers by the city necessary? Should a fireman who cannot and will not fire a locomotive smokelessly be employed at all; and if he does fire his engine smokelessly, should he be rewarded for his superior skill and care?

9. Can Illinois coal be coked, and if so, what are the obstacles in the way of its adoption as a fuel for locomotives, as to increased cost of operating?

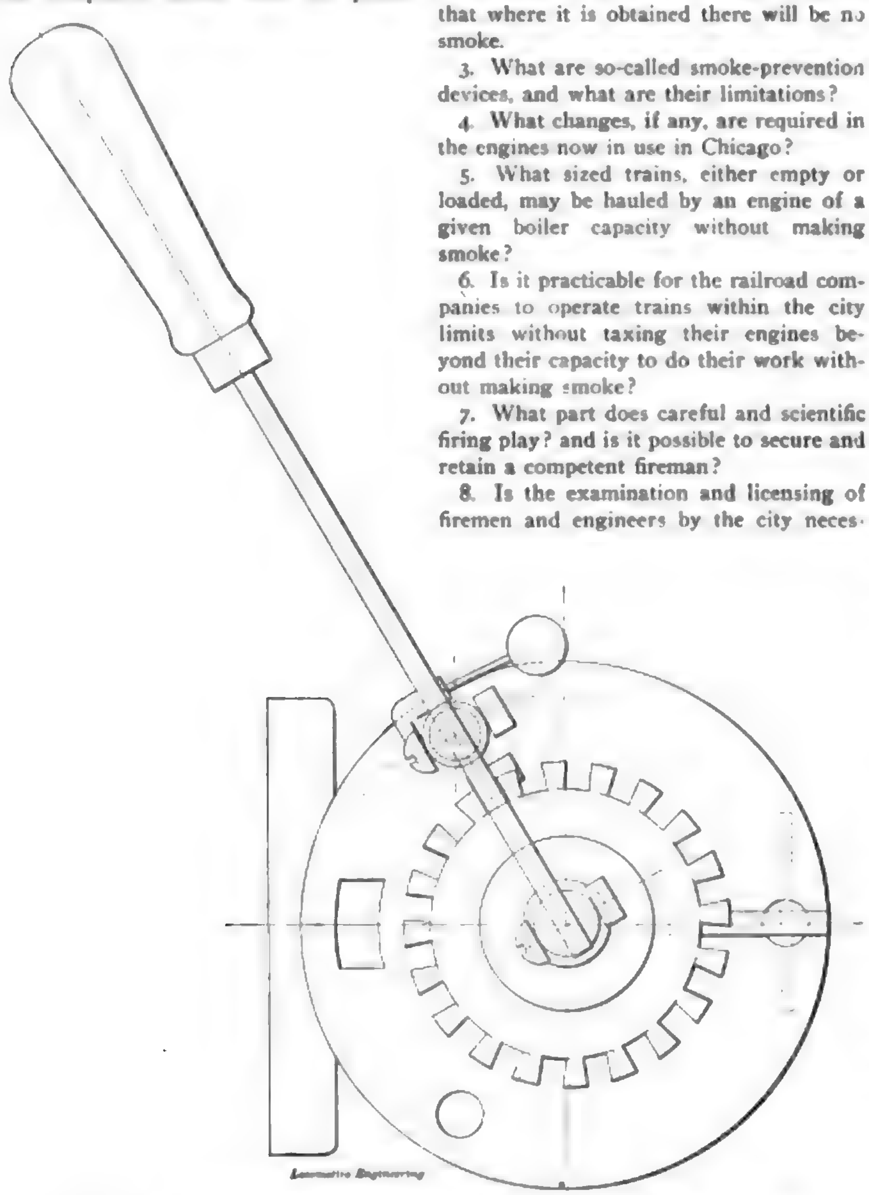


FIG. 2. HAND MACHINE FOR GRINDING PISTON RINGS IN TRIPLE VALVES.

10. Is it conceded that coke is a smokeless fuel?

11. Are not some of the very inferior grades of coal used largely responsible for locomotives smoking?

12. Do all railroads running into Chicago use about the same grade of coal, or do not some use a very good quality, while others use that so poor that the most careful and intelligent stoker cannot avoid making smoke?

Mr. Schubert's paper said that one of the first causes of trouble was careless and unscientific firing; next in importance was the character of the fuel used, and the fact that the trains handled inside the city limits were too heavy for the locomotives to handle with their limited boiler capacity without making considerable smoke.

Both these gentlemen gave the railroads credit for trying as hard as possible to abate the nuisance, and suggested that a united effort by all interested would go far towards making the movement a success.

Mr. Robert Quayle, superintendent of motive power of the Chicago & North Western Railway, said that this attitude of the Health Commissioner and Smoke Inspectors is very fair to the companies. He took up the questions propounded by Dr. Reynolds, saying that the coal supply was governed by rules they could not always control, and they could not always get the exact kind of coal they wanted, but had to use it as it came to them. Second, as to grate surface; a great many of the older pattern of engines were still used in Chicago, which had small grate area. The new and later designs have more, which makes the problem easier to meet. Third, as to devices; they have used several, but that careful firing is necessary with any of them.

Mr. Waldo H. Marshall, superintendent of motive power of the Lake Shore & Michigan Southern Railway, favored the appointment of a committee. The railroads are anxious to make the engines smokeless, but they do not want to change all the engines used in Chicago or change the fuel till they find out whether this will effect a cure of the evil.

Mr. Robert Miller, superintendent of motive power, Michigan Central Railroad, said they were making an honest effort to comply with the law as far as they were able, either with devices or looking after the firing as done by the men; that discipline was necessary at times to have the matter attended to properly.

Prof. Smart, of Purdue University, said that the problem of operating locomotives near and at terminals was different from on the road. He regarded absolutely smokeless firing as impossible; the conditions under which the locomotive does its work are such that at times smoke will be emitted with the best of appliances and careful firing.

Mr. P. H. Peck, master mechanic of the

Chicago & Western Indiana Belt Railway, stated that they had the most trouble with engines doing short switching, working hard for a short distance, then shutting off for an instant and working steam again. This allows black smoke to come up When an engine slips on a crossing or at any place and is shut off, it makes it smoke, no matter how skilfully it is fired. On long, steady pulls they can get good results.

Mr. J. C. McMynn, consulting engineer of R. W. Hunt & Co., spoke at length in favor of the use of coke for locomotive service, stating that the Boston & Maine Railroad was using it exclusively, with the very best results.

After some other discussion on the smoke-producing properties of the various kinds of coal, the president appointed Mr. G. R. Henderson, assistant superintendent of motive power, Chicago & North Western Railway; Prof. R. A. Smart, of Purdue University; J. C. McMynn, engineer of tests of R. W. Hunt & Co.; R. D. Smith, master mechanic, Chicago, Burlington & Quincy Railroad, and J. W. Suttrell, master mechanic, Illinois Central Railroad, as this committee.

The paper on "Piece Work in a Railroad Shop," by R. T. Shea, was read, and is to be discussed at the November meeting.

Where File Cutting is a Dangerous Trade.

Those who have enjoyed the privilege of visiting file-making establishments in this country and noted the admirable sanitary arrangements, would have been surprised to learn that the trade of file-cutting was classed as a dangerous one. We do not think it is classed as dangerous in America, but this is no doubt due to the care taken to prevent the workers from suffering from lead poisoning, resulting from the dust given off from the lead cushions upon which the files rest while being cut.

A very different condition of affairs prevails in the British Isles. Some time ago a committee was appointed by the British Board of Trade to investigate dangerous trades and report upon their condition. The first report was recently presented, and a good synopsis of it was published by *Engineering*. From this we learn that a great part of the file cutting in Great Britain is still done by hand, and most of the work is carried on in the houses of the artisans. The conditions are the most unsuitable possible. There is no ventilation; the wife as well as the husband works, regardless of consequences and dirt; food is cooked and eaten in the lead-laden atmosphere. In few cases can the workers cleanse their hands and faces before taking their food. Here is a quotation from the report of the secretary of the File Cutters' Society:

"After careful study of the subject, I am fully confirmed in my opinion that a great deal of the ill-health of file-cutters (by hand) is the result of their neglect of the most ordinary sanitary precautions and the lack of personal cleanliness, and the wearing of clothing until it becomes saturated with grease and lead dust. An apron is never worn, and in many cases the same garments are used for extra bed covering, and in some cases worn every day, Sunday included. I desire it to be clearly understood that the men referred to are a class of men who form the substratum, and who seldom, if ever, are found at respectable firms, largely in consequence of their habits. So far as the general body are concerned, in my opinion, the strict enforcement of the provisions of the Act is ample in providing facilities for washing of hands before meals and securing ample air space and limewashing of workshops. In many shops due regard is not paid to the cleansing of the floors, which in some cases are not paved. Some better system might be introduced with advantage which would lend itself to greater cleanliness in the shops. As regards the personal cleanliness referred to, I confess I despair of ever accomplishing anything of a permanent character with men who wilfully waste their time in dissipation, and consequently have neither the disposition nor means to properly care for themselves."

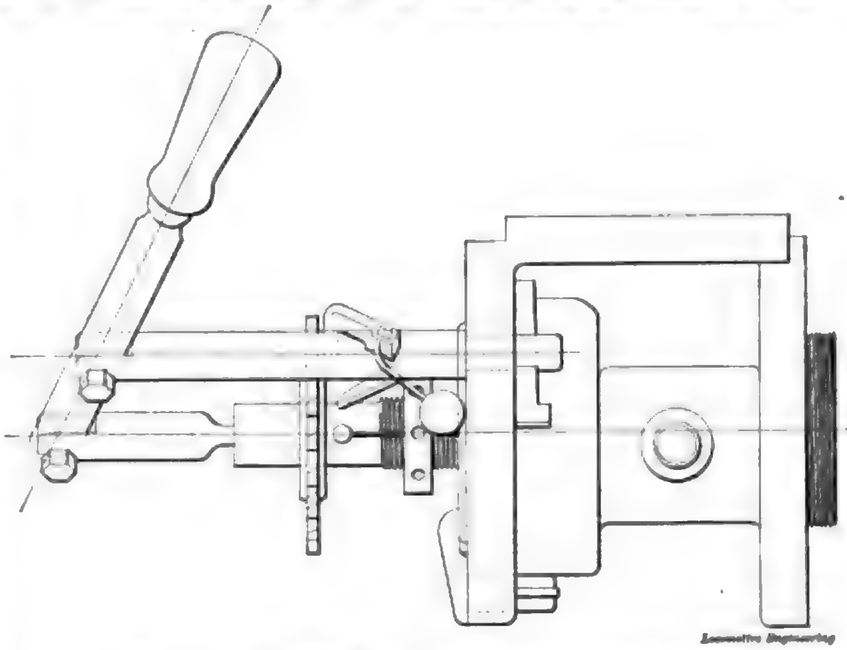


FIG. 3. SIDE VIEW OF TRIPLE PISTON RING GRINDING MACHINE.

The demand for hand-cut files continues to be undiminished in Europe, but happily in the United States machine-cut files are growing more popular year by year. It is not that a machine-cut file will not do the work about as well as one cut by hand that keeps the latter popular in Europe. The preference for the hand-cut file rests on the strength of conservatism, which cherishes things that are old in preference to those that are new.

When Ten Miles an Hour Was High Train Speed.

The South Carolina Railroad was one of the first built on this continent, and it was the first corporation to have over 100 miles of track. It had the reputation of being the most progressive railroad doing business; but an old time table printed in 1852 gives curious testimony about what was considered high speed at that time. The old schedule shows that the night express between Charleston and Columbia, which is a distance of about 130 miles, made the trip when it had good luck, in twelve hours and fifteen minutes, but the public was warned not to expect such a feat every day. The freight service between the two points was scheduled to cover the run in twenty-nine hours, there or thereabouts. That was a shade better than 4½ miles an hour, and was considered so fast that there was a special order to trainmen to stop at the first siding "in dense fogs and wait for same to lift." It seems that order gives one a wonderful picture of the good old times. Think of a through freight roosting on a siding, waiting for a fog to lift! Nowadays the passenger trains make the run from Charleston to Columbia in four hours exactly. According to the '52 schedule, there was an express that left Charleston at 5 P. M. and arrived in Hamburg at 6 the following morning. The distance is 136 miles. A freight for Aiken, 120 miles away, left at the same hour, and reached its destination at 9.40 next night. Ten miles an hour was considered remarkable speed for passenger trains in those days, and an old inhabitant told the writer that many people declined to risk their necks at such a gait. From what we know of the rolling-stock equipment, they showed their good sense.

PERSONAL.

Mr. Fred Massey has been appointed roundhouse foreman of the Louisville & Nashville at Pensacola, Fla.

Mr. W. J. Hunter has been appointed assistant superintendent of the California Northwestern, with office at Tiburon, Cal.

Mr. Mord Roberts has been appointed general master mechanic of the Louisville & Nashville, with office at Louisville, Ky.

Mr. F. L. Morse has been appointed assistant superintendent of the Central Railroad of New Jersey, with office at Jersey City, N. J.

Mr. R. L. Stewart has been appointed master mechanic of the El Paso & Northeastern, with headquarters at Alamogorda, N. M.

Mr. E. L. Gilboy has been appointed assistant superintendent of the Eastern Minnesota at West Superior, Wis., vice Mr. George T. Ross, resigned.

Mr. George J. Hutz has been appointed division master mechanic of the Illinois Central at East St. Louis, Ill., succeeding Mr. A. C. Beckwith, resigned.

Mr. S. F. Forbes has been appointed assistant superintendent of motive power of the Central Railroad of New Jersey, with headquarters at Jersey City, N. J.

Mr. W. P. Taylor has been appointed superintendent of the Montana division of the Great Northern at Havre, Mont., succeeding Mr. J. M. Davis, transferred.

Mr. W. G. Bunison has been appointed general manager of the Kansas City & Northern Connecting Railroad, vice Mr. E. H. Shaufler, resigned; office at Quincy, Ill.

Mr. George T. Ross, assistant superintendent of the Eastern Minnesota, has been appointed superintendent of the Montana Central, with office at Great Falls, Mont.

Mr. W. D. Scott has been appointed assistant superintendent of the Breckenridge division of the Great Northern at Breckenridge, Minn., vice Mr. F. J. Hawn, transferred.

Mr. W. F. Heacock has been appointed general foreman of the Kansas City, St. Joseph & Council Bluffs machine shop at St. Joseph, Mo., succeeding Mr. E. M. Crandall.

Mr. George F. Evans has severed his connection with the Westinghouse interests, having resigned as manager of the Westinghouse Manufacturing Company, Limited, Canada.

Mr. J. R. Wentworth has been appointed superintendent of the Missouri division of the St. Louis, Iron Mountain & Southern at De Soto, Mo., succeeding Mr. D. Hardy, transferred.

Mr. Milton P. Cheney has been appointed road foreman of engines on the Chicago & West Michigan and Detroit, Grand Rapids & Western, vice Mr. George A. Kingsley, resigned.

The Mobile (Ala.) shops of the Southern have been consolidated under one master mechanic, with headquarters at Selma, and Mr. T. E. Farwell, general foreman at Mobile, has resigned.

Mr. A. B. Quimby has been transferred from the position as general foreman of the Chicago & Northwestern shops to that of foreman of the Dakota division, with headquarters at Huron, S. Dak.

Mr. William Bennett has been appointed assistant superintendent of the Sioux City & St. Paul division of the Chicago, St. Paul, Minneapolis & Omaha at St. James, Minn., vice Mr. S. G. Strickland.

Mr. C. Van Dusen, trainmaster of the Wheeling & Lake Erie at Masillon, Ohio, has been appointed superintendent of the Cleveland division of that road at Canton, Ohio, succeeding Mr. F. H. Keeshen.

Mr. Charles P. Coleman has been appointed purchasing agent of the Lehigh Valley, vice Mr. William C. Addison, who has been elected treasurer of that company; headquarters at Philadelphia, Pa.

Mr. Thomas W. Smith has resigned the position of general foreman of the Atlantic Coast Line at Rocky Mount, N. C., to accept a position as erecting engineer for the Aultman & Taylor Machinery Company, Mansfield, Ohio.

We have received a notice from the Lehigh Valley announcing the removal of the office of Mr. Rollin H. Wilbur, general superintendent, from South Bethlehem, Pa., to the Havemeyer Building, New York, N. Y.

Mr. F. J. Hawn, assistant superintendent of the Breckenridge division of the Great Northern, has been appointed assistant superintendent of the Montana division, with office at Havre, Mont., succeeding Mr. E. E. Lillie, resigned.

Mr. W. E. Green, general superintendent of the Kansas City, Pittsburgh & Gulf, has been appointed superintendent of the Southern division at Texarkana, Texas, vice Mr. O. H. Crittenden. The office of general superintendent has been abolished.

Mr. D. Hardy, superintendent of the Missouri division of the St. Louis, Iron Mountain & Southern at De Soto, Mo., has resigned to accept the position of superintendent of the Missouri Pacific at Sedalia, Mo., in place of Mr. L. D. Hopkins, resigned.

Mr. W. F. Bentley has been appointed master car builder of the Baltimore & Ohio east of the Ohio River, with office at Mt. Clare, Baltimore, and Mr. E. A. Westcott has been appointed master car builder west of the Ohio River, with office at Newark, Ohio.

Mr. John P. Neff has been promoted to the position of foreman on the Chicago & Northwestern at Waseca, Minn., vice Mr. H. Montgomery, assigned to other duties. Mr. Neff graduated from Purdue four years ago, since which time he has been with the above company.

Mr. G. R. Brown has been elected second vice-president and general manager of the New York & Pennsylvania, with office at Canisteo, N. Y. Mr. Brown was formerly on the Beech Creek, and is famous in the railroad world for having devised the Brown System of Discipline without Suspension.

Mr. J. W. Hardy has been appointed traveling engineer of the St. Louis & San Francisco, succeeding Mr. M. Savage, resigned. He was formerly employed by this road as engineer, and resigned to accept a position on the Denver & Rio Grande. He goes to the "Frisco" from the Florence & Cripple Creek.

The men in the mechanical department of the Chicago, Lake Shore & Eastern at South Chicago gave their general foreman, Mr. John H. Ruxton, a pleasant surprise before his departure to take charge of the Omaha, Kansas City & Eastern shops at Stanberry, Mo. He was presented with a gold watch, chain and charm as a token of the high esteem in which he was held.

Mr. Robert C. Blackall, superintendent of motive power of the Delaware & Hudson Company, has retired from active service at his own request, and has been appointed consulting mechanical superintendent, with headquarters at Albany, N. Y. The duties of superintendent of motive power will be performed by Mr. J. R. Slack, assistant superintendent of motive power, with headquarters at Albany, N. Y.

John Ebbert, the first locomotive engineer in the West, and one of the first in the country, died last month at his home in Chicago, aged 85 years. Mr. Ebbert was in early life a locomotive engineer on the old Boston & Albany Railroad, and went to Chicago in 1842, taking with him the first engine to leave the East. It was named the Pioneer, and was placed in service on the old Galena Railroad, part of which is now the Chicago & Northwestern Railway. Mr. Ebbert was later master mechanic on that road and also on the Ohio & Mississippi.

Mr. Henry James Kimman, mechanical superintendent for the Standard Pneumatic Tool Company, sailed for England last month in order to superintend the installation of machinery in the works of the International Pneumatic Tool Company, Chippenham, England, which company recently purchased the right to manufacture and sell the "Little Giant" pneumatic tools and appliances in the British Empire. After concluding his work in that country he intends to make a tour of inspection and instruction among their agencies in Paris, Brussels, Berlin, Dusseldorf, Vienna and Amsterdam.

Mr. W. J. Murphy, superintendent of the Queen & Crescent Railroad, has been placed in control of the property in the absence of President Spencer, and it is understood that he is to be retained permanently in a high position at Cincinnati.

There are few abler railroad men in the United States than W. J. Murphy, and under his supervision changes have been made on the Queen & Crescent which have established for that road a universal reputation for speed, safety and cleanliness. Mr. Murphy was once connected with the old Atlantic & Great Western Railroad, with headquarters at Meadville, and has many friends in the Pittsburgh district.

In the course of a recent tour through Russia, Germany, Belgium, France and Great Britain, Mr. D. A. Wightman, of the Pittsburgh Locomotive Works, found a good reception at every manufacturing establishment he wished to visit, with one notable exception. This exception was the Neilson Locomotive Works, of Glasgow. A curious thing about the exception, too, was that one of the officials of the Neilson Locomotive Works was in America a short time ago and visited the Pittsburgh Locomotive Works, being shown every courtesy. We know, from experience, that Mr. Wightman would not find anything new to him in the Neilson Locomotive Works, and we are inclined to suspect that the refusal was based on the people in charge being ashamed to show the shortcomings of their tools and methods to a man who is a recognized expert.

The announcement that Mr. J. N. Barr, superintendent of motive power of the Chicago, Milwaukee & St. Paul, had resigned to become the head of the mechanical department of the Baltimore & Ohio, was a great surprise to railroad men generally, and to Mr. Barr's friends in particular. Mr. Barr went from the Pennsylvania Railroad to be mechanical engineer of the Chicago, Milwaukee & St. Paul thirteen years ago, and his strong personality has pushed him to the front until for years past he has been recognized as a powerful leader and authority in everything relating to railroad rolling stock. The surprise is that he has consented to leave the comfortable routine of his position on the Milwaukee to enter upon a field of stirring activities incident to reorganizing the mechanical department of a huge railroad system. It is reported that the inducements offered to make the change are extraordinarily liberal.

The Oldest Engineer Gone.

A press despatch from Red Bank, N. J., on October 17th says:

"Joseph Wood, the oldest locomotive engineer in the United States, died to-day at the home of his daughter, Mrs. William J. Sickles. He was nearly ninety years old. He was born in Bordentown, and at the age of seventeen got employment on the steamboat 'Superior,' which plied on the Delaware between Philadelphia and Bordentown. In 1831 the famous 'John Bull' locomotive was shipped from England to America, and on November 12th of that year a trial trip of the engine was made on a mile track near Bordentown. Isaac Dripps was the engineer, Mr. Wood being the wood-passer. Mr. Dripps has been dead some years.

"Mr. Wood subsequently was engineer on the Camden & Amboy Railroad, and afterward master mechanic of the Raritan & Delaware Bay Railroad. From 1841 to 1859 he was engineer for the New Jersey Transportation Company. During the war, from 1861 to 1864, he was employed by the government as superintendent of water supply for engines from Alexandria south.

"After he quit railroading he turned his mind to inventions, and brought out a number of appliances now in general use on railroads. Among the inventions were Wood's improved frog, the rubber hose connecting the water tank with the engine, a steam whistle and the sand pipe. He was a trustee of the First Methodist Church many years. His wife died about three weeks ago, but he leaves one daughter and two sons, James, of Jersey City, and John, of New York, both of whom are locomotive engineers."

Is Pure Water Unhealthy?

It has been admitted for years by steam engineers that absolutely pure water causes corrosion in boilers, and it has become the practice in marine service to admit sufficient sea water into the boilers to keep the condensed water slightly tinctured with lime or salt. It appears now that some physicians have found evidence that absolutely pure water obtained from distillation is injurious to the human stomach. The discussion on this subject originated in Germany, but several American physicians and chemists have given their views. One writer says:

"Distilled water taken on an empty stomach would tend to leach out the cells with which it came in contact, and we know that the life of the cell depends upon the maintenance of its contents at a certain standard. This is a well-established fact, and not, as one advertisement implies, a vision of a mad microscopist. The testimony of physicians that the prolonged use of distilled water has a tendency to decrease the body weight shows a lessening of nutritive power in the tissues. Most persons eat enough salt on their food to bring up the average, and many persons in middle life, and after, eat too much of all kinds of food and drink too little fluid, so that for them a course of distilled water may be most beneficial, carrying away an excess which would be harmful. If an individual over forty is living on potatoes pared before cooking, white bread, unsalted butter, cream, fruit and sugar, then distilled water would be superfluous if not harmful; but if the diet is rich in meat, in cereals, in milk, and abundant at that, it is very probable that distilled water would remove more of the excess than would a hard water taken as a beverage."

Examining and Instructing Railway Employés.

Most of our readers have some knowledge of a method followed by Mr. W. J. Murphy, superintendent of the Cincinnati, New Orleans & Texas Pacific, in the instruction of trainmen on signals, etc., in which he makes use of a stereopticon. This graphic method of instruction has proved highly satisfactory, and now Mr. Murphy has given it a wider application by publishing a small book describing the system. The description of the signal system is aided by a variety of colored plates, and makes the operation and meaning of the signals very plain. In fact, we have never seen a description of station signals so comprehensive and simple as that published by Mr. Murphy.

The author is well impressed with the necessity for trainmen understanding fixed signals, for he says that a thorough knowledge of the signals and the different combinations of signals is of vital importance; that it is as essential that trainmen readily read and understand the signals as it is that they read and write the English language.

In addition to the information about signals, the book gives illustrated examples of how accidents to rolling stock can be most readily remedied or put in condition for being moved.

The book is for sale, but we are not informed about the price. Particulars can be obtained on application to W. J. Murphy, Cincinnati, New Orleans & Texas Pacific Railway, Lexington, Ky.

A recent decision of the Court of Queen's Bench, one of the highest courts in Great Britain, holds that a railway company cannot be compelled to carry a bicycle for nothing. The decision of another court was that baggage consists of such articles of necessary or personal convenience usually carried by passengers for their personal use. As bicycles could scarcely be considered as a necessity for personal use, railroad companies were not required to class them as baggage. These are common sense decisions, and it is difficult for even an enthusiastic bicyclist to insist that there is anything unfair about them.

There is a good deal of agitation going on, where huge freight engines are in use, to have two firemen on each engine. So far it has been found impossible to get men who can stand the work of keeping up steam in these monster engines, and there has been much trouble in getting good results with the green firemen. With two firemen on these engines they could be handled much better, and the engineer's duties would not be so hard, as he would have more assistance. Some of the general managers are now seriously considering the advisability of having three men on each of the big new freight engines.

Sent on Approval.

John A. Hill's two new books are the best things out in a long time.

"Stories of the Railroad,"

just published by "McClure's Magazine," contains ten good human railroad stories, with love and live steam in them.

"Jim Skeevers' Object Lessons"

contains twenty-one sketches about railroading for railroaders. Hill has been through the mill from the scoop up, and is yet, as he always has been, "one of the boys."

Jim Skeevers gives pointers on the operation and maintenance of locomotives by the use of "object lessons." Tells how things work out in practice, regardless of the theory, and *vice versa.*

There is a lot of fun in the work, but none of the facts is neglected. You ought to have these two books for Christmas.

They are the best work of the hand of John A. Hill, alias John Alexander, alias Jim Skeevers, who has written so much that was interesting to railroad men. Mr. Hill is the author of "Progressive Examinations for Locomotive Engineers and Firemen," which has reached a sale of upwards of 30,000.

The publishers' price of "Stories of the Railroad" is $1.50; of "Jim Skeevers' Object Lessons" $1.

Special Offer.

We will send the two books, postage paid, to one address for a two-dollar bill sent with the order—saves you fifty cents.

Or, we will send the two books

On Approval;

you to examine them, and if not satisfied, return them to us by express at our expense.

You will never let them go once you see them, handsomely bound and printed and with "meat" in them.

If you are satisfied, send us the retail price for the two, $2.50.

We will trust any railroad man in this country who knows how to read and write. Not the least bit afraid of being beat.

Send in your order now.

Idiotic Engineering Criticism.

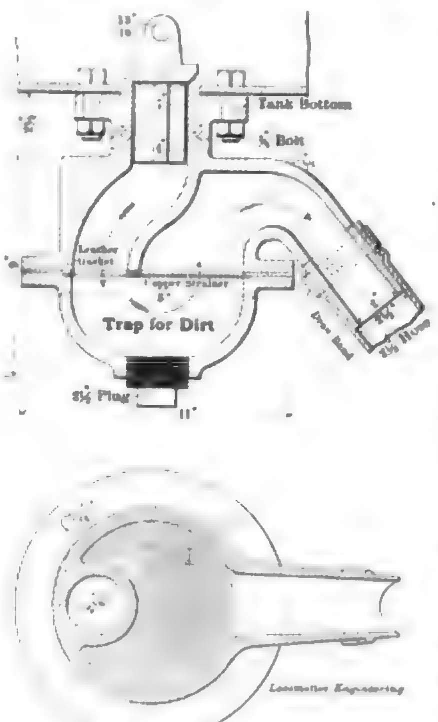
In discussing the details of some twelve-wheel locomotives recently built by the Brooks Locomotive Works for the Lackawanna, the *Railway and Engineering Review* says: "It is singular that no effort is made to permit of the weakest point of a driving box being strengthened by increasing the width between the pedestal jaws in designing the frames. The proportions of pedestal jaws, driving boxes, shoes and wedges are in this case representative of the customary practice, the driving box being even stronger than usual, through its heavy flanges it is very probably of cast steel. But it will be seen that the spacing of the pedestal jaws is 14½ inches, taking out the 11 inches for journal, leaving 3½ inches, or 1¾ inches on a side.

"Taking away the ¾-inch shoe and ¾ inch for thickness of brass, we have left but ¼ inch of metal in a new box between the brass and the shoe of wedge. This is strengthened by the heavy flanges and weakened in some cases by brass holding plugs, and further weakened in all cases by pressing in the brass at a pressure of several tons, and that this point is not strong enough is shown by nearly all boxes breaking on a line through this point."

It is generally recognized that the usefulness of criticism in engineering journals or in engineering discussions is to point out vicious designs or the use of unsuitable material. Yet here is a writer criticising dimensions that he is utterly ignorant of. We have not looked into the real dimensions of the journals of the Lackawanna locomotives, but if they exceed 9 inches in diameter they are phenomenally thick. Yet here is a reputed engineering critic with skull evidently as thick as the driving box flanges, who bases an argument on the journals being 11 inches in diameter. When a locomotive goes into service with that size of journal we should like to know all about it.

A New Injector Strainer.

We show with this a new strainer for keeping foreign matter out of the injector, so that it can work undisturbed by chunks



NEW INJECTOR STRAINER.

of coal, pieces of wood or straw from birds' nests. This resembles somewhat the casting used regularly by the Wabash road, excepting that this is parted in the middle and a strainer bolted in as shown, and the outlet is at the top instead of the bottom.

Even without the strainer this form will keep the injector free from everything except floating pieces, as solid matter will settle and can be drawn out at the plug.

The strainer, however, effectually prevents anything interfering with work of injector, and the larger area of strainer, shown in lower view, allows ample water to pass even with a large portion stopped up. Closing tank valve allows the plug to be taken out to clean the trap without losing any water except that in the strainer itself.

This is the invention of Mr. J. P. Hays, who is connected with the Wabash road at Moberly, Mo., and is to be made by the Bass Foundry Company, of Fort Wayne, Ind. Patent has been applied for.

Those who have paid much attention to the subject of draft appliances for locomotives could not fail to observe that one of the most intelligent workers in this line is Mr. J. Snowden Bell, of Pittsburgh, who has invented several improvements that are calculated to overcome several weak points in the ordinary arrangement of front ends. At a recent meeting of the Western Railway Club a most valuable paper by Mr. Bell was read on "Locomotive Front Ends." We regret that we cannot find space for the paper in full for it is a valuable contribution on the subject of draft appliances and spark arresters. We hope, however, to make an exhaustive synopsis of the paper in an early issue.

There is a car famine in some parts of the country, and as usual when this condition of affairs comes round, certain railroad officials are showing themselves to be thieves in their eagerness to take possession of their competitors' cars. An official who will deliberately steal the cars belonging to another line may be depended on to steal from his employer when the opportunity comes about. A natural thief may possess attributes that will help a company in an emergency, but he may be depended upon to prove an expensive luxury in the long run. None but those who believe that dishonesty is the best policy can afford to keep in their employ a dishonest car accountant.

We notice that the *Electrical World and Engineer* has made an export edition of its issue of October 7th, and it is a particularly interesting feat of technical journalism. There are fifty pages of reading matter very finely illustrated and a great variety of articles, most of them of a very interesting character. The illustrations are particularly good and will compare with anything of the kind to be found in any magazine, even in Locomotive Engineering. There are over 100 pages of advertising, which form the real foundation on which this huge export edition rests.

Philadelphia & Reading Subway.

The work of sinking the tracks of the Philadelphia & Reading Railroad in Philadelphia is nearing completion, and Pennsylvania avenue has already been freed from surface tracks. From Thirteenth street to the entrance of tunnel shown, which is near Twenty-second and Hamilton streets, is an open cut with the cross streets bridging it at every block. The tunnel, however, has openings for air and light, which are protected by stone walls. Around these will be planted shrubbery similar to the Fourth avenue tunnel of the New York Central in New York city. The incline at the left of this view will be one of many sidings by which to run freight water supply on hand, which is to be commended. There are four tracks through the tunnel, and everything about the work appears to be very substantial in every way. It will be a great improvement over the old condition, and will probably be in full working order within a few months.

ENTRANCE TO TUNNEL, P. & R. R. R. SUBWAY.

up to establishments along the route, these being, in a measure, private tracks. The small arch sprung under the sidewalk at the upper right hand of tunnel has an odd look at first sight.

The traveling crane shown in the next view illustrates the solution of another problem connected with submerged tracks. This spans one or two tracks for unloading local freight, and as it also extends partially over the street, handles material right from cars to wagon. The freight cars seen on the street are on temporary tracks.

The shop and engine-house are to be located to the right of the crane structure, and next to the wall, so that all material for this can be handled in the same way. In the foreground is the roof of a large signal tower.

The water tanks and turntable lie between the traveling crane and the mouth of tunnel, and are just about completed. They evidently mean to have an ample

Easy Drifting Engines.

When an engineer shuts the throttle and "lets her drift," the cylinders are turned into air pumps, as everyone knows. Cinders are drawn into steam chest at times, and as the air drawn in must also go out again, there is a blast on the fire at a time when it is not needed.

Once I ran an engine that had the steam chest on the side of cylinder toward the frame, so the valves were vertical. There was a fairly liberal bearing on the lower side for it to run on, but after a time this got worn so the valve would drop away from the seat when I shut off. This allowed the air from one end of cylinder to go over into other end and back again. There was no drafting of fire when not wanted and she was the "freest" drifting engine on the road. By opening the throttle just a crack could blow the fire nicely, but a little too much opening would clap the valve to its seat in a hurry.

In the case of compounds, this air-pump business is exaggerated, on account of larger areas of cylinders. The Richmond people seem to be the only ones to think this amounts to anything, but I feel that it does. Their over-pass valve allows the air to play back and forth, and the engine must drift easier for it. There are, of course, other ways of accomplishing the same result, but that it is accomplished is the main thing.

On mountainous roads this ought to make a difference in the economy, for the engine is drifting a good share of the time, and if it is not drafting fire too much, and is running free, the coal consumption must be reduced.

It must also be remembered that a compound will not make as good a showing on a hilly road unless it is uphill both ways, for it is only saving fuel while at work.

R. E. MARKS.

Camden, N. J.

Who Begs a Brother of the Earth to Give Him Leave to Toil.

There are a good many prosperous men in the country who at some time or times in their lives have endured spells of hard luck. Those who look back to times of hardship, and perhaps suffering, nearly always remember with gratitude kindnesses extended to them by railroad trainmen. Trainmen have wonderful keenness in detecting the genuine working man looking for employment from the professional hobo, and they are nearly always ready to give the seeker for work a lift. There is grim truth in the remarks made in the following paragraph, cut from the *Pittsburgh Post:*

"I can always sympathize with a penniless man who is hunting for work," said a Pittsburgh railway official. "Once in my younger days I started out to seek employment, and finally 'went broke,' as they say. I was given the cold shoulder by people who pretended to be Christians, and knocked about like a thief, simply because I was poor. Well, I traveled over two states on foot, and never begged a bite, but got all I wanted to eat on the way, simply because I tried to be original. When I got to a town and wanted something to eat before starting to hunt work, I searched around the back alleys and peered into the lots. When I saw a pile of wood and a bucksaw I climbed over the fence, took off my coat and went to work. I never had to work very long until my labor attracted attention, and then either the lady or the gentleman of the house would come out and ask who hired me. 'I have hired myself,' was my usual answer. 'I am in need of food and don't want to beg.' This racket worked splendidly with all who had ever worked themselves, but some people who were above work and despised a poor man would order me off the premises. I can only say God help the poor man in this country who is out of work and becomes ragged."

The Pennsylvania Railroad have put arc lights in their yard at the Meadows, and also lighted the roundhouse with them. This is a much-needed improvement on many roads, and it is safe to say it will pay in the increased work that men can do when they have a good light instead of a smoky old torch.

Traveling Engineers' Convention.

LOCATING RESPONSIBILITY FOR UNFAIR USAGE OF LOCOMOTIVES.

At the last meeting of the Traveling Engineers' Association the question of "Locating the Responsible Engineer When an Engine Has Been Subjected to Unfair Usage Under the Chain Gang or Pooling System" was very thoroughly discussed. Certain paragraphs of the report said:

"To successfully pool engines it is first necessary to provide the engines, and they should be in good condition, especially if the road is handling important traffic; next, sufficient help and facilities to maintain the power; then organize your engine crews. Pooling engines can be done and good service obtained if the pooling is handled as it should be. Where the pooling of engines is a failure, as a rule, is on a road when on account of increased volume of business for three or six months of the year, the road is short of power and can see no other way out of the difficulty, and a bulletin notice is issued by some authority that hereafter all engines in certain service or all engines will run in a pool. And that is about as far as a good many roads go to perfect or organize their shop force or engine crews for the pooling system, and the result is, power is not maintained to its highest efficiency, work reported on the engine is not done by shop foremen, who do not have time, and figure that if she came in all right she ought to go out. We all get so far behind that it is impossible to catch up, and numerous failures are the result.

"We believe that condition reports properly filled out by engineers and good live inspectors, a united effort on the inside of the turntable to do the work to keep the power up, a close touch with the operating department, or a weekly report of inferior locomotive service giving the nature of the failure, the engineer, engine and train, stating what the failure is, hot pins, boxes, no steam, doubled hill with number of tons less than rating, all go to show up the man that is not up to the average.

"We do not feel that any set of rules could be gotten out that would be just what is wanted for all roads and under all conditions. We recommend that engineers running in the pool be required to carefully inspect the engine at the end of each trip, reporting all the necessary work on blank provided for the purpose; this report to be given to the roundhouse foreman, who will forward same to the master mechanic when the work is done; and if anything requiring especial care or attention has been done on the engine, a note left on the engine for the engineer taking her out, informing him that certain work was done on the engine that trip, would be an advantage. Should the foreman be unable to do the work reported by the engineer and the engine be sent out, it should be so stated on the work report blank that the work had not been done, and on what account. There should be a competent man to inspect the engine on her arrival, noting defects, and his report should be given the foreman in charge or written in a book, that it may be compared with the report of the engineer if found necessary. If the inspector found defects that were not reported by the engineer and ought to have been seen by him when he made his inspection of the engine, a comparison of these two work or condition reports would locate the man who failed to properly inspect and report work on the engine. This would locate the responsible man very easily, and he would be located before anyone else took the engine out."

In regard to the unfair usage which engines received while in service, the general agreement was that the traveling engineer while riding on the engine could locate this a great deal better than any system of reports; but that a system of reports should be inaugurated, which, of course, should be retained, and, no matter how briefly, they could state the condition of the engine at the end of each trip, and

TRAVELING CRANE FOR HANDLING FREIGHT, P. & R. R. R. SUBWAY, NO. 2.

WATER TANKS AND TURNTABLES, P. & R. R. R. SUBWAY, NO. 3.

be signed by the name of the man who makes it out.

In regard to this inspection Mr. Wallace, of the Northwestern, says that it is an advantage to have the inspector look over the engine at the same time the engineer does, at the end of the trip.

As a side issue, Mr. Malone, of the Big Four, asked if the oil bill, which might be reduced by systematic pooling, could not be still further reduced with the same rules for shop work on the engines as were enforced with a pooling system, provided a man had the same engine all the time. This question was not answered directly, but indirectly it was concluded that keeping the engines in good shape for use in the pooling system would help out at all times.

At the close of the discussion a committee was appointed to suggest a set of rules to govern pooling, but their report did not bring out anything new. The rules will be noted later.

LONG RUNS FOR LOCOMOTIVES.

A kindred subject to this, "Long Runs of Locomotives with a View to Economical Treatment and Maintenance, from the Traveling Engineer's Standpoint," was discussed. The report was very brief indeed, but the discussion was taken up at a greater length.

Mr. Hickey, of the Big Four, said that on long runs with double-crew engines they made from 8,000 to 9,000 miles per month with each engine; in some cases they used two engines with three crews. The engines run about 450 miles in a continuous trip per day. Engine failures have not increased any. They have not yet inaugurated a system as to whom the fuel and oil used will be charged. As to saving of power, they used six engines where they formerly had eleven doing the same work. As the enginemen live in the middle of the divisions, they do such work as is required of them at the terminals when away from home, which gives them all their time to themselves while at home.

Mr. Hogan, New York Central, said that he favors it in every way; get more mileage and better service.

Mr. Widgeon said the Vandalia line has a rule requiring the incoming engineer to oil around and get engine ready for the next man to go out with, as he knows best the condition of the journals and the amount of supplies required for the coming trip. Their engines make from 9,000 to 12,000 miles per month. The engines must have the best of care when at terminals.

Mr. Bullock, of the Chesapeake & Ohio, stated that he ran a double-crewed engine for some years, 9,000 miles monthly, with only three engine failures charged to the engine between shopping for general repairs.

Mr. Meadows, of the Canada Southern, stated that at St. Thomas, in the middle of the run, where the crews are changed, both crews assist in getting the engine ready for the rest of the trip; this saves delays there.

On the whole, the discussion showed that long runs of engines, if the work was properly systematized, effected a large saving in the expense per mile, as well as doing away with about one-third of the number of engines.

The Committee on "Boiler Compounds and Purges, from the Standpoint of a Traveling Engineer" reported that the use of soda ash as a boiler compound is spreading on account of the good results it gives. The fireboxes and flues last much longer and give better service. One point which they laid particular stress on was that the boiler should be furnished with plenty of blow-off cocks, which should be used regularly, in order to keep the density of the water down, so as to prevent foaming, as well as blow the deposits out before they would have settled on the top surface and become baked on. The report is a very able one, but hardly brief enough for our columns. In regard to the expense of this, the average cost of compound per 1,000 miles is between 25 and 35 cents, and the life of the flues has been increased from 50 to 75 per cent.

YOUNG MEN FOR FIREMEN.

The report of the committee, "In Regard to Employing or Recommending Young Men for Firemen, and Their Qualifications," said in part:

"It has been often said that the fireman of to-day is the future engineer. In the beginning of the railroad development of this country, machinists and steamboat engineers were often employed to run locomotives, but that day has passed, and it is now certain that the successful engineer is the man who has learned the trade on the deck of a locomotive in actual service. Operating the locomotive and drawing trains from one station to another is a small part of an engineer's duties; he must be fully acquainted with the rules and running regulations of the train service and quick to realize the safest and most certain plan to get the train over the road exactly on time; this in addition to the mechanical knowledge necessary to handle all the various attachments now connected to a locomotive, which must be gained through experience. In addition to this knowledge there is much that can be gained by the study of proper text-books.

"The time has been when the educational qualifications required of an engineer were very moderate, but that day has long since passed, and to-day he has need for talent of a higher order to fill the position. Therefore a better grade of young men must be selected to start with, or else depend on the engineer bringing himself up to the high standard required after his promotion. His experience and observations which make him valuable are gained at the expense of the company in the use of fuel, machinery and supplies, as well as in the use of the time of those who show him how the work should be done when he begins his apprenticeship.

"All of this will be wasted if, after his promotion to more responsible positions, either as a fireman on an important train, or later to an engineer, it is proved that he has not, and never will have, the abilities necessary for a successful engineer.

"It is the unanimous opinion that the applicant should not be very old, as young men absorb and retain correct information in regard to a new business more readily than those nearer middle age.

"In a great many cases there are legal objections in the way of employing anyone as a fireman who has not reached the legal age of a man, twenty-one years. Where that does not make any difference it is the opinion that eighteen is a good age to start a new man in, and some of the members consider it an advantage to start them in as wipers, then use them on the repair force to give them an idea of how the work around an engine is done. There is one objection to this; if a boy is kept too long at this work he gets discontented and shiftless and learns habits which are a trouble to him afterward. Therefore, unless promotion from wiper to fireman comes inside of six months, it is no use to have the young fireman take this course. If there is a force of hostlers employed caring for, firing up and moving the engines in and out of the house, cleaning fires, etc., it is of value to have the young man assist them when possible, as that is more in the line of his future duties.

"As to the highest age limit there is a difference in the views, some placing it at twenty-five years, and one or two going as high as thirty-five years, only one member setting it as high as forty years. While the question before us speaks of the qualifications of young men only, yet some of them may have had some experience in railroad service previously, and this experience should be taken into consideration when the higher age limit is fixed.

"If a man has fired before and given good service, it is the opinion that the age limit could be placed higher than in the case of new men. The general opinion is that from twenty-one to twenty-five years is the proper age to start new men, for various reasons; they learn easier, have no ideas gained from other lines of business they may have followed that will interfere with railroad work, and they are just in their prime of life when, after promotion, they begin the duties required of an engineer on the main line. The applicant should make out in his own handwriting, in the presence of the officer who is to employ him, an application setting forth his exact age, giving the year and month of his birth, the fact that he is in sound health and not physically disabled in any way, what his educational qualifications are and what schools he has attended, what he worked at previously and

his present occupation. He should give references in writing from some men of character and standing in the community where he has lived, and a school certificate showing how high in the various grades he has been, or a certified copy of the one issued to him giving dates, etc. The applicant's verbal statement should not be taken for this; it should be in writing. At the same time the officer can easily judge from a short conversation on general subjects whether he possesses an active mind and is likely to make a good fireman. At this conversation it is just as well to take up the matter of the temperance question, both as to habits and language, for the use of ill-tempered language with other employés is just as bad as the use of liquor, although the law does not look at it as bad.

"If accepted, the applicant should have his sight and hearing tested by the company's surgeon before being set to work. Several of the members state that he should also pass a physical examination at the same time, to make sure that he is not suffering from any disability that will affect him in service.

"As to the educational qualifications, it is unanimously agreed that a good common-school education is absolutely necessary, with a good idea of mathematics. The applicant must be a fair penman, as so many written reports are required of enginemen at the present time.

"In some cases the evident leaning of the young man towards mechanical matters is considered a good point. This is true if not carried to an extreme point of the inventive genius who is not content to let the machine alone, but must be making continual changes in it and with various results, chiefly in the line of failures. A mathematical education is of more value than one in the line of languages, as the engineer must be a ready calculator and the mathematical education makes him a rapid thinker."

In the discussion of this report, it was agreed that in order to have a supply of eligible young men ready to begin service as firemen in case of a sudden demand for them, on account of increased business or bad weather, that it would be necessary to have applications sent in, and wherever possible give the applicants an opportunity to learn something of the business which they expected to follow, by sending them over the road on an engine, with a regular crew, to not only learn the road, but also learn the business. This, of course, would be at the expense of the applicant; but if he saw the disagreeable side of the business and did not like the work, he would not come up at all when called on, and in this manner the company would not be put to loss by taking him on and putting him in service at a time when his services were greatly needed. The point was raised that the legal side of the question must be looked out for, in case a man was injured on an engine learning the road. This point, of course, the association could not settle; but we cannot see where a man learning the road would be in any different position, in case of a claim for damages for injury, than the regular man, who was paid for his services. Several of the traveling engineers stated that they followed the plan of having eligible young men on the waiting list, and that when they needed men they had no difficulty in getting them to work on short notice. When a new man applied for a position as fireman, he was examined as to eyesight and physical condition; his qualifications considered just the same as if regularly employed. He was at once sent out for a few trips to learn the business, and when the engineer he had ridden with was willing to recommend him, he was put on the "waiting list," with a promise of employment as soon as a vacancy required him.

Improved Methods of Instruction.

The International Correspondence Schools are making a new departure which will add to the interest and value of their instruction cars. These are to be equipped with stereopticon apparatus, so as to fully illustrate any point brought out in the instruction papers. These are, we understand, to be capable of showing moving pictures, and, aside from entertaining purposes, will be of great value in showing the working of valves and similar problems.

With each of their three cars provided with this apparatus and the services of a good instructor, they will be able to clear away many of the knotty problems which come up in everyday practice.

DOWN IN THE GUMBO.

Dropped Into the Gumbo.

The derailed engine shown herewith belongs to the Port Arthur route, and the picture gives a good idea of the wild country through which this road runs. One of our friends sent us the photograph from which this picture was taken and another one where the engine is much deeper in the mud, but the photograph of the latter was so dim that we could not make use of it.

The Leeds pilot push-bar, which folds back and obviates the danger of knocking stock down on the track, is becoming very popular. Mr. Leeds has lately effected an improvement upon it in the shape of a swing joint which makes it flexible in rounding curves.

What seems to us a real grievance on the part of men working on the shop piece-work system in some places, is that the officials in charge incline to take the performance of the best workmen as the basis on which to establish prices. That is not an equitable way of doing it. The amount of work that will be produced in a shop under the day or hour system of pay will be the work of the average workman multiplied by the number at work. The inferior hand offsets the greater output of the first-class hand, and so that reduces the output to the level of the average hand. This being the case, the payment of piece work ought to be based on what an average man can perform and earn fair wages.

It is reported that the South Western Railway of England are about to introduce American refrigerator cars to carry the perishable freight landed from steamers at Southampton.

Schenectady Double-Ended Consolidation Engine.

The extremely powerful double-ended consolidation locomotive hereby shown was recently built in the Schenectady Locomotive Works for The Dominion Coal Company, of Cape Breton, Nova Scotia. The engine was designed to conform with specifications of the Dominion Coal Company, and was made of the type illustrated to conform with the particular conditions of service met with on the company's railroad. It has been reported that the engine has gone into service very satisfactorily, and is meeting the requirements in all respects. So far as we are aware, this is the largest and most powerful double-ended locomotive ever built.

In working order the engine weighs 239,000 pounds, of which 170,000 pounds

The main driving axle journals are 9 x 10 inches, and the other driving axle journals are 8½ x 10 inches. The main crank pin journals are 7 x 6½ inches, the main side rod pin journals 7¼ x 5 inches. The forward and back side rod pin journals are 5 x 3½ inches, and the intermediate 6 x 4½ inches.

The boiler is straight 72 inches in diameter at smallest ring and the thickness of the plates from 23-32 to 11-16 inch. The firebox is 114 inches long, 41⅞ inches wide and 67½ to 70½ inches deep. Liberal water space is provided around the firebox, varying from 4 to 3½ inches. The crown sheet is supported by radial staybolts 1½ inches in diameter, and the other staybolts are 1 inch thick. There are 348 2-inch tubes, 13 feet 10 inches long, providing 2,512.55 square feet of

an X-casting, so that the water from the right-hand injector goes into the left-hand pipe and *vice versa*. There is a division in the X I believe, so each stream is separate. Then I followed the piping and found it ran outside the boiler to nearly the front end.

Questions come up as to the necessity of delivering water into the front end and the loss in heat units on a cold night from having the delivery pipe outside and fully exposed. If it is best to deliver at front end, why not run pipe inside of boiler and save the heat. R. E. MARKS.

Camden, N. J.

The late John C. Trautwine, author of "Rules and Tables for Engineers," whose fame as an engineer of the highest rank will continue as long as the engineering

SCHENECTADY DOUBLE-ENDED CONSOLIDATION ENGINE.

rest upon the drivers. The total wheel base is 36 feet 3 inches, of which 15 feet is rigid, representing the driving wheel base. The cylinders are 22 x 28 inches, the driving wheels are 55 inches diameter outside of tires, and the boiler carries steam of 200 pounds pressure per square inch. Worked out in the usual way, these dimensions and particulars show that the engine is capable of exerting about 42,000 tractive force, and that the ratio of tractive power to adhesion is about 4.

An examination of the dimensions of the engine shows that it is noted for ample bearing surfaces, liberal heating surface and large grate area—three characteristics which have much influence in making a good locomotive.

heating surface, the firebox having 176.92 square feet, making a total of 2,689.47 square feet of heating surface. The boiler is covered with Keasbey & Mattison's sectional magnesia covering. There are two Crosby 3-inch muffled safety valves. Leach sanding device and Star chime whistle. All the drivers have the American steam brake. Two Hancock inspirators are used for boiler feeding.

Piping Injectors.

I noticed on the new consolidations of the Pennsylvania—class H 6 I believe they are called—that the injectors are piped up rather peculiarly and, it seems to me, foolishly. They are on the back head of boiler, and the delivery of each runs into

profession endures, and whose book is probably the most satisfactory and accurate work on engineering for ready reference extant, said, while referring to the great works on engineering compiled by Rankine, Weisbach and others, that he admitted them to be the work of master minds, and to exhibit a profundity of knowledge beyond the reach of ordinary men, but that their language is also so profound that very few engineers can read them. He having long since forgotten the little higher mathematics he once knew, could not understand them. To him they were but little more than striking instances of how completely the most simple facts can be buried under heaps of mathematical rubbish.

Name of a Life Saver.

In the August number of your magazine, under the caption of "Another Hero," you quote from a dispatch from Vancouver, B. C., the report of an event which occurred on the Canadian Pacific road. You say: "The heroes of railroad life appear to stand forward every time when the call for bravery arises." That is very true; but when a man has done an unusually meritorious deed it would seem no more than fair that it should go down to posterity with the right name attached to it. In the interest of justice to the gallant man himself I write this. As I was on the train, I am quite familiar with the circumstances.

The trains in both instances were the Imperial Limiteds—east bound and west bound—both due at Cherry Creek very nearly at the same time. The former consisted of an engine, tender and twelve cars, the last one being a C. P. sleeper, on which were twenty-seven New England newspaper men and ladies. The excursion train, with the main body of the editorial party, was held at North Bend, nearly 100 miles away. Our train was stopped at Savonas, 10 miles west of Cherry Creek, not far from 10 o'clock, with the news that the bridge at Cherry Creek was burned. We did not run down to the scene of the disaster until 11 o'clock Sunday morning, and then we crossed on a temporary foot-bridge put up during the interim.

The gallant man's name was Laurence Murphy—the name you give him is merely a nickname by which he is known on the road. He was employed by the road to guard against just such an accident as happened, and he showed remarkable grit and faithfulness in the discharge of his duty. He had a long swim, the water must have been uncomfortably cold, and he had to clamber up a steep, rocky bank and run to the nearest station, from which he could telephone. Associate with that the fact that the brave, faithful fellow was sixty-two years old, and the heroism of his act becomes even more marked.

A. Starbuck,
Editor *Daily Free Press-Tribune*.
Waltham, Mass.

Frame Splices.

The advent of the "large locomotive," with high boiler pressure, makes it imperative that the cylinders and the adjacent parts should be firmly and securely fastened. This fact has led to carrying the double bar frame out beyond the cylinders, spanning the saddles. Experience has taught valuable lessons in this regard, so that the methods illustrated herewith represent the result of experience and careful study. Fig. 1 shows the plan used by W. S. Morris, superintendent of motive power of the Chicago & Ohio Railway, on some heavy consolidations built by the Richmond Locomotive Works.

It will be noticed that the front bars are tongued into the upper and lower bars of the main frame, and provision made, on either side of the tongue, for keying and drawing together of both front and back portions. Fig. 2 shows method used by the Richmond Locomotive Works for some compound freight locomotives for the Canadian Pacific Railway. Attention is directed to method used on the low-pressure side, where the front rail is dovetailed into the top rail of main frame.

Fig. 3 illustrates the form in general use by the Schenectady Locomotive Works, which shows the use of a cast-steel spacing piece to stiffen and bind the two ends of the main frame, where the splices come, and Fig. 4 shows quite plainly the method employed by the Pittsburgh Locomotive Works. All of these forms are interesting, as they illustrate good practice that has withstood the test of trying service, and, incidentally, are excellent examples of modern method of securing the cylinder to the frames.

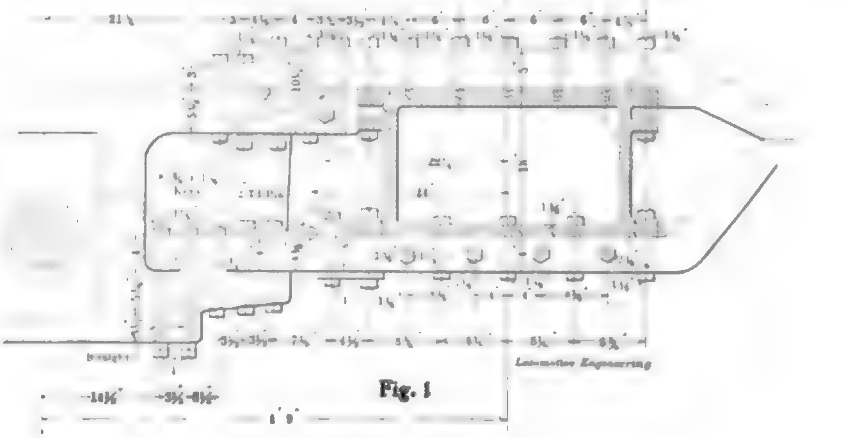


Fig. 1

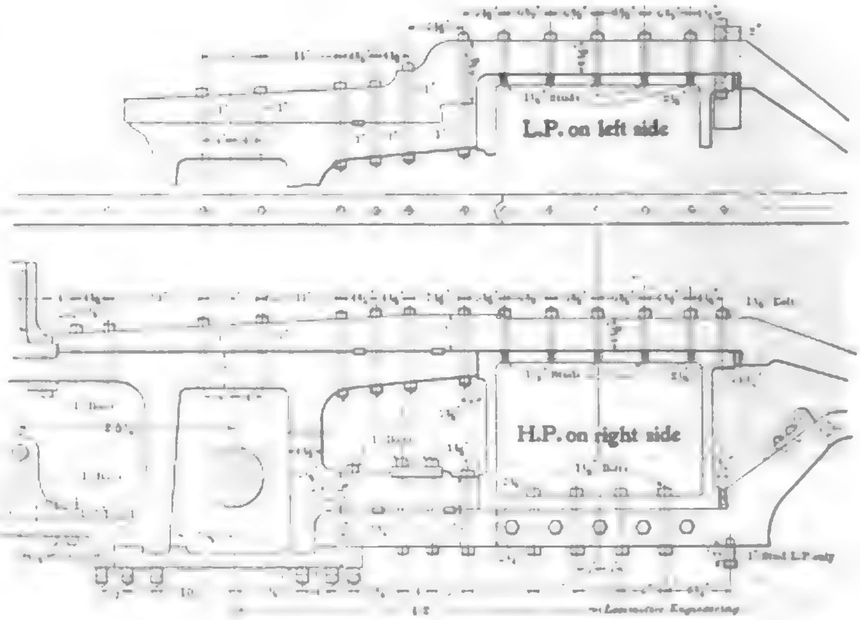


Fig. 2

Another Way of Estimating Speed of Trains.

In your October number, page 455, in answer to question 93, you give a rule to estimate the speed of a locomotive at slow speeds. Please allow me to give another that can be used when it is not convenient to count rail joints. Take 2-11 of the diameter of the driving wheel in inches and call the same seconds. Then as many revolutions as are made in that many seconds such is the rate of miles an hour, providing there is no slip. Example—Take a 66-inch driving wheel, 2-11 of which is 12, called 12 seconds. If 18 revolutions are counted in 12 seconds, the engine is going at the rate of 18 miles per hour.

H. G. Alvord.
Somerville, N. J.

If firemen looking with fear to a coming examination will consult us, we can give them good advice.

Chicago Pneumatic Tool Company Booming.

The ten new Boyer long-stroke riveting hammers made by the Chicago Pneumatic Tool Company, which the Pressed Steel Car Company have had in use for some time at their Allegheny shops, have proven so satisfactory that they have now placed an order for sixty more of these hammers.

The hammers are used for riveting in the erection of the cars manufactured by that company, and have proven durable and rapid, and effecting such a saving in labor as to greatly expedite the work and increase the productive capacity of the works.

Severe tests were made to determine the desirability of using these riveting hammers, and the results of these tests are indicated in the order just placed for sixty of them.

These long-stroke hammers are the greatest advance yet made in pneumatic tools, and orders for them are already taxing the manufacturing facilities.

Twenty-five of the new Pennsylvania consolidation engines, H 6 class, have just been turned out by the Baldwin Locomotive Works, and they contain many points of construction which are not generally met with. Among them are the cast-steel forward portion of frame, the splice being behind the cylinders. The cylinders are cast separate from the saddle, and the forward portion of frame is bolted between the cylinder and saddle. The frame in this part is a slab 2 inches thick and the depth of the cylinder. This makes a strong job, and one that is sure to give satisfaction. The bumper is cast iron—cored for lightness, as there is weight enough on the truck without it—and extends back between the frames nearly to the saddle. On the outside of each frame is an angle casting, bolting frame and bumper together and forming a stiff tie or brace between the frames.

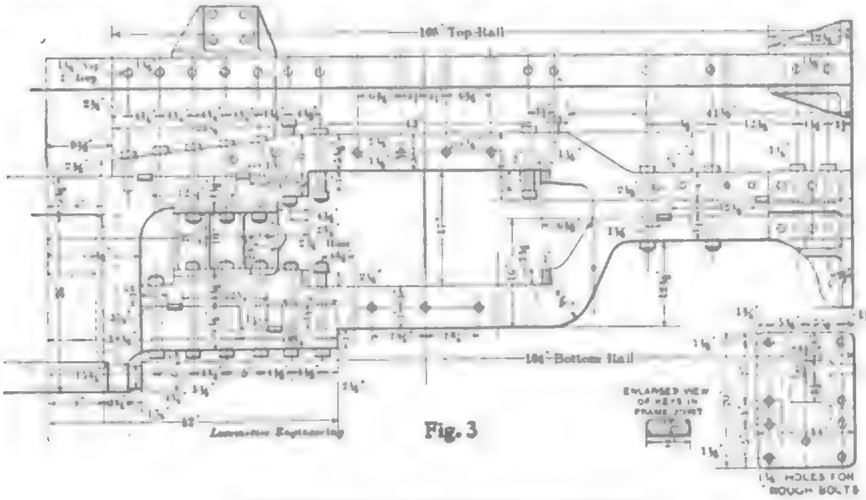
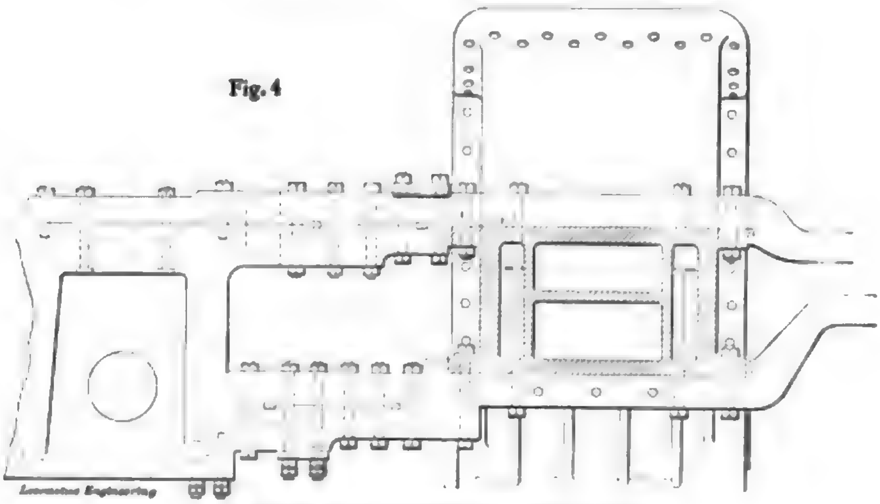


Fig. 3

SCHENECTADY LOCOMOTIVE WORKS FRAME.

Fig. 4



PITTSBURGH LOCOMOTIVE WORKS FRAME.

Firemen preparing for the examination that will give them promotion to the right-hand side, should not fail to read "Locomotive Engine Running and Management," by Angus Sinclair. Contains the questions and answers prepared by the Traveling Engineers' Association, and is a manual of information about the locomotive.

A Breakdown—Train Timing.

BY H. ROLFE.

WHAT CAUSED STEAM CHEST COVERS TO BREAK?

The other day a breakdown occurred on one of the roads in this State that may be of interest to some of your readers as having sufficed to set certain parties by the ears. The engine was drifting down a 30-mile grade, in fore gear, when she broke both her forward eccentrics, the result being two bursted steam-chest covers. This happened when near the bottom of the grade. My informant says the traveling engineer blamed the runner, maintaining that the latter had pulled the lever over when he felt her go. The runner, however, swore he didn't. The M. M. and another traveling engineer (belonging to a large contract shop) both backed up the first-mentioned T. E., so it was three to one against the unlucky engineer. Now, my idea is that he could have easily been telling the truth; in other words, we might reasonably expect the steam chests to suffer as they did without his having reversed her. For when the fore eccentrics broke, the valves would stop, as the back eccentrics could have no command over the rockers, owing to the links being right down. They could simply oscillate the links round the rocker pins as centers. It is pretty clear that the back eccentric-rod can't move the rocker pin to and fro when the forward rod is disabled, for then the latter's restraining influence is gone and it ceases to supply the necessary fulcrum (a moving one, true) while the other rod shifts the rocker pin. If the back eccentrics had broken, the result, I imagine, would not have been the same, as in that case the forward rods' complete control of the rocker would have remained practically unaffected. So I conclude that the valve stopped in a position closing the steam ports (one or both), and then the air in front of the advancing piston couldn't get away, and so lifted the valve bodily and took the cover with it. Being a balanced valve, there would be very little space for it to yield through, and the compression coming on it so suddenly, the little it *did* lift from its seat failed to relieve the pressure quick enough to prevent its hitting the pressure plate a severe blow, and so the cover gave way.

I know of no particulars as to what made the straps break. It is safe to suppose they had got hot though; if so, it wasn't with hard pulling, for she had been drifting for the last 40 minutes. This particular road, however, is noted for cutting down on the oil supply, so you can draw your own conclusions. If I am wrong, an expression of opinion from someone else who *may* hit on the right explanation will doubtless interest the engineer in question, if it don't do him any good.

[We certainly indorse the view taken by our correspondent, and think that the traveling engineers and master mechanic were mistaken.—Ed.]

The Ajax Metal Company, of Philadelphia, are adding to their testing department one of the very latest improved testing machines, and in future they will not only be able to obtain the analytical and microscopic tests, but also physical tests, such as friction, wearing and compressive qualities. In other words, they propose to make practical tests of all material entering into the journal boxes in railroad service, which will consist of bearing metals, oil and waste. These demonstrations will be published in the trade papers as they progress, using standards of all material in comparison, taking those that are largely used in the service, and those which are not, but should be. Mr. J. G. Hendrickson, president, is somewhat familiar with the lubricating qualities of oils, having been connected with the Standard Oil Company prior to taking up the metal business. They would be pleased to correspond with all who are interested.

A Kentucky genius has patented a four-cylinder locomotive with more connecting rods than we have ever seen. Both cylinders lie outside the frames and side by side, making a greater width than is permissible. The outside cylinder connects with the rear drivers, while the inside ones connect with the forward pair at 180 degrees from the rear pair. Both axles have two cranks, also at 180 degrees, and are connected together by two *inside* rods. Altogether, it's a beauty, and if anyone wants to see the freak they can do so by sending five cents to the Patent Office for a copy of patent No. 626566, issued June 6th of this year.

"The Long Island Railroad is following the lead of other roads," writes a correspondent of the Pittsburgh *Dispatch*, "and forbids its brakemen to seize women to help them off the cars unless they are feeble or elderly. The brakemen have been in the habit of bawling at every woman: 'Now, lady, step lively,' following the mandate with a cindery embrace. They are commanded by a recently issued order to address every woman as 'Madam,' to drop the 'step lively' command, and to keep their hands off. If this cutting off of brakeman's privileges continues 'there will be nothing in railroading any more,' as one disgruntled brakeman observed, with an expression of extreme disgust."

The railroad man who has not heard of Skinny Skeevers is to be pitied. The mechanical railroad man who has not read "Skeevers' Object Lessons" has missed wonderfully helpful reading. Make up for lost time by sending one dollar to this office for the book. You will admit that the money has been well spent.

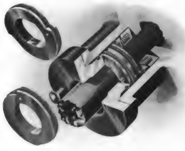
A New Metallic Packing.

The illustration shows a new form of metallic packing which has just been put on the market by the Reeves Machine Company, of Trenton, N. J., and for which several strong claims of superiority are made.

It is the invention of Mr. Frank E. Harthan, superintendent of the above company, and has been applied with marked success to all kinds of stationary service, and is now making its way into the railway field.

As will be seen, the packing consists of a ring divided in a rather peculiar manner, and merely held in place by the light coil spring shown. This enables the packing to be renewed at any time without taking down rod, which is of course a convenience.

The rings are made of gun-metal or bronze, and have no babbit in them whatever; yet recent tests at the Worcester Institute of Technology showed the friction to be very low—in fact, only about half that of a good soft packing under similar conditions. Mr. Harthan offers to pack any piston rod, no matter how badly scored, as long as it is parallel, so that there will be no blowing after a few hours' run; but, of course, advises a good rod. It is certainly worth looking into, and we are informed that a new catalogue is now ready for distribution.



NEW METALLIC PACKING.

The Baltimore & Ohio South Western Railroad placed in service several months ago five large ten-wheel compound passenger engines for use on fast trains between Cincinnati and St. Louis. The performance of these engines has been eminently satisfactory and up to the highest expectation. The same line has also in service fifty consolidation compound freight engines, which provide ample power for the entire line in addition to what was already in use. The compound engines were an experiment, but hard service has proved that they are entirely successful, and show a saving of 15 per cent. in fuel as compared with simple engines of the same type. Exhaustive tests were made with both the simple and compound locomotives before the order for the entire lot was placed, with the result vastly in favor of the compound locomotives.

"With the locomotive threatening to blow up at any moment, a train ran all the way from Wreck Lead to Lynbrook, on the Long Island Railroad. It was a slow ride, but an exciting one. To stand beside a boiler that may at any moment be blown to pieces, needs nerve and devotion to duty. Both were shown by the engineer and fireman of the Long Island train. The train was from Long Beach. At Wreck Lead the locomotive refused to move. An investigation showed that the respirator which forces water into the boiler was not working. The train hands turned in with buckets, and saved the lives of all on board." So says the New York *World* of July 28th. There is something picturesque about the conception of a bucket brigade filling up the boiler when the "respirator" fails to work. We guess David Harum would say of the reporter that sprung this item, that it "ha'int rained wisdom an' knowledge in his part th' country fer quite a spell."—*The Locomotive.*

A recent press dispatch says: "Mrs. William Swartwood, of Mountain Top, near Wilkesbarre, Pa., gave birth to her twenty-fifth child yesterday. It is a boy, and strong and healthy. He has twenty-one brothers and sisters living, three others having died. He is an uncle several times over. The husband is an engineer on the New York Central Railroad."

Our valve-motion model, which is sold for $10, a price that includes one year's subscription to LOCOMOTIVE ENGINEERING, puts a useful educational apparatus within the reach of all. It combines ornament with usefulness.

Black Diamond Express.

Mr. Charles S. Lee, G. P. A., Lehigh Valley Railroad, has been investigating the subject of fast through trains, and the facts learned have convinced him that the Lehigh Valley Black Diamond Express, running between New York and Buffalo, is one of the most important trains run between those two points.

This train covers the distance of 447.53 miles between New York and Buffalo in 9 hours 55 minutes westbound, and 9 hours 58 minutes eastbound. These figures include stops, which, taken out, would make the running time of the train 50 miles per hour.

The maximum speed and distance of this train under regular schedule is as follows:

Westbound, 68 miles per hour for 44 miles.

Eastbound, 63 miles per hour for 29 miles.

In addition to the figures given above, a speed of 80 miles an hour is often made and maintained in emergencies by these Black Diamond Express trains for distances from 10 to 20 miles.

We have been favored with a set of the instruction papers issued by the American School of Correspondence, Boston, Mass., and find them very well written, profusely illustrated and of a practical nature. The method of treatment seems to be clear, and there is no doubt as to the value of these courses to any mechanic who wishes to learn. With all of the attempts that have been made to teach mechanical engineering by correspondence, there are only two schools which we are acquainted with that we could recommend. These two are represented in our advertising columns; and while the student must choose for himself, he will never regret the time and money spent with either if he follows the work faithfully.

Mr. William Cox has sent us a list of the fifty-seven different computers he has designed, and among them we note about every subject which interests an engineer. They include gas, water, steam, electricity and compressed air in various forms. Anyone using the same formulas repeatedly will find one of these computers a great time-saver. All Mr. Cox needs is the formula, and with that he will construct a computer for any work. His address is 216 Murray street, Elizabeth, N. J.

Mr. C. R. Petrie, whose writings are well known to the readers of Locomotive Engineering, has issued a small pamphlet called "Practical Instruction on Schenectady Compounds." It contains a great deal of information, and will be a handy reference for those operating Schenectady compounds. His address is Los Angeles, Cal.

Bicycles are not baggage, so declare the three judges of the St. Louis Circuit Court of Appeals. The baggageman of a Missouri Pacific train refused to receive a bicycle in his car. The owner brought suit for mandamus to compel the company to carry his vehicle under the same provisions as those for ordinary baggage, and was successful in the Circuit Court. The company appealed and its practice has been sustained.

A pretty illustrated brochure, termed "Roseville," has been published by Mr. I. C. Eagles, who is connected with the Delaware, Lackawanna & Western. Roseville is a pretty town on the railroad named, about seven miles from New York. It contains a great many pleasant residences, many of which are illustrated by good half-tones. Among these is the dwelling place of our S. P. Besides the private residences there are views of railway stations and various public buildings. We understand that the pamphlet will be sent to anyone on receipt of a 2-cent stamp by I. C. Eagles, Roseville, N. J.

The St. Louis Railroad Club have inaugurated a question box, into which any member can put a question for discussion at next meeting. The box was filled up with so many questions on the first night that it will take all this season to discuss them. This plan of raising discussions has been carried on very successfully in engineers' and firemen's lodge meetings. We notice that the Pacific Coast Railroad Club has also adopted the same means of bringing out information.

Mr. Pulaski Leeds, superintendent of motive power of the Louisville & Nashville Railroad, said at the Traveling Engineers' convention that "a good fireman is the proper smoke burner. He may not know just how he does it, but he gets the proper thickness of fire for the right amount of air to pass through. Teach your men first that they do not need to take so many shovelfuls of coal to keep up steam, if properly spread over the grate of an even thickness."

The Baltimore & Ohio Railroad Company have determined to equip the entire main line with water troughs, from which locomotives can take up water while running. It is the intention to equip not only passenger locomotives with the apparatus needed for lifting the water, but also all locomotives used on fast freight trains.

At the end of September the International Correspondence Schools of Scranton, Pa., had 7,800 railway students. The institution has grown with wonderful rapidity, and its monthly increase of members is becoming greater with much regularity.

Curious If True.

It is said that when the sweat caused by defective ventilation collects on the inside of lamps used for switch or fixed signal lights with colored lenses, that it has the effect of so obscuring the colored rays that when the colored light is first seen at a distance it is apt to be mistaken for a dirty white light. This condition is liable to allow an engineer to run up closer to a colored light before he notes its correct color than is consistent with safety.

We do not give this for a scientific fact, but it would be well to look into it. At any rate, it is an argument for clean lenses.

"A Book of Success" is the name of a small booklet recently issued by the International Correspondence Schools, Scranton, Pa. It consists mainly of information about men who have risen from workmen to officials through the information they have received by going through the Correspondence School course. Among the testimonials in favor of the school is one from Mr. J. S. Chambers, division master mechanic of the Central Railroad of New Jersey, who talks very favorably of the advantage he gained from taking the course.

The Joseph Dixon Crucible Company, of Jersey City, N. J., send out so many attractive little pamphlets concerning the use of Dixon's graphite that we have difficulty in keeping the run of the whole of them. The latest one which has come to our attention is called "Dixon's Ticonderoga Flake Graphite for Cylinders and Valves." It gives a great deal of useful information about the advantage of using graphite for the purposes named, and has some very graphic illustrations of the advantage of good lubrication. The pamphlet will be found particularly interesting to engineers and others in charge of machinery.

The Bethlehem Steel Company, South Bethlehem, Pa., have offered to furnish nickel steel locomotive forgings at a reduced price to railroad companies. There is a great deal of uncertainty about nickel steel forgings for locomotive work, and it would be a good plan for all leading railroads to purchase some of these forgings and put them into service, so that tests will be made of the value of that material.

Those who are interested in electrically-driven machine tools, and this includes all progressive shop men, will want a copy of bulletin No. 4535, issued by the Bullock Electric Manufacturing Company, of Cincinnati, Ohio. This contains sixteen pages of information about their direct-current, multipolar motor, type "N," and is well worth sending for.

Three train robbers bound and gagged the signalman at a signal tower 50 miles west of Chicago on the Chicago & Northwestern one night last month, and then they stopped a passenger train and proceeded to rob the express car. The trainmen made some resistance, and a brakeman escaped and wired the superintendent about the hold-up, but the robbers managed to blow open the safe and carry away part of its contents.

In a letter recently received from Mr. George P. Whittlesey, Washington, D. C., we are informed that the double reverse lever latch, illustrated in our October number, was invented and patented by Mr. Charles May, a road foreman of engines on the Pennsylvania Railroad. Mr. Whittlesey now has control of the patent, and people using the latch would do well to communicate with him before applying it to a locomotive.

The Big Four Railway Company have adopted on some of their trains the method of making up their passenger trains with sleepers next to the engine, the coaches next and baggage cars last, thus reversing the usual practice. This arrangement is claimed to make the sleepers ride steadier, although this practice has been in force some years on the Mexican International, with the object of lessening the pouring of dust into sleepers.

Just why the drunken man and the deaf man select the railroad track to walk upon has always remained a mystery. If, as has been suggested, the ties and ballast allure this unsuspecting person there to a health promenade, that particular kind of health must be of another world, to which world he usually goes when brought in close and forcible argument with the "cowcatcher" of the engine disputing the right of way.

The New York Central Railroad Company have arranged to make a material increase of their capital stock, the money to be used for the betterment of the property. Among the new rolling stock to be purchased are said to be 10,000 new cars and a large number of locomotives.

An English railway paper mourns the fact that the practice of "tipping" is on the wane. We are sorry to say that the practice is on the increase on American railroads. A passenger cannot buy a sandwich on an American eating car without the porter looking for 25 cents.

The new catalogue of the American Locomotive Sander Company, of Philadelphia, shows the Leach, Houston, "She," Dean and Curtis sanders, which they make. Anyone interested in sanders can see how they are made and how they operate. They will be sent to our readers on request.

Handling Oil by Air.

The oil-supply room of the West Philadelphia shops of the Pennsylvania Railroad does not draw their oil from visible tanks in the usual way. All that we see going into the room is a neat metal rack for cans and faucets from which to draw the supply.

The tanks are down below the floor, and the oil is forced up by air pressure. This varies from 4 pounds for the lighter oils up to 10 pounds for the heavy grades. This is, of course, similar to the system of furnishing water on the Pullman car, and it makes a very neat arrangement, too.

This is due, we believe, to the general foreman of these shops, Mr. William B Norris, whose device for handling and testing flues we mentioned recently.

The Lackawanna route is going to be pictured. The company have engaged the services of F. P. Stevens, of Colorado Springs, who is famous for the wonderfully perfect photographs he has taken of mountain scenery. He is now out with his car on the Lackawanna, and we will be much disappointed if he does not photograph scenes which will bear comparison with those taken in the Rocky Mountains.

At the October meeting of the New York Railroad Club some of the members discussed the subject of uniform dimensions for a typical box car. We could not hear of any new light being thrown upon this ancient subject. The impression carried away was that it was left quite as threadbare as it was before, and that is saying a great deal.

The New York store of the Q & C Company, corner Liberty and Church streets, recently had an interesting exhibit in the shape of the battle flag carried by the United States brig "Enterprise" in her action with the British brig "Boxer," off Portland, Me., on September 5, 1813. This is supposed to be second oldest United States flag in existence.

There is something very odd in the political fight in Kentucky this year. The would-be Governor on the Democratic ticket started out on an anti-railroad crusade. Finding that abuse of railroads was not working well, since it alienated hosts of railroad employés, he has changed his course and promises to abolish double-heading if the railroad men will help to elect him Governor.

Mr. A. O. Norton, manufacturer of ball-bearing jacks at Boston, Mass., has recently shipped a large order to Denmark. Within the past thirty days several orders of considerable size have been received from Australia, South Africa and India.

We are informed that the compound passenger and freight engines on the Baltimore & Ohio Southwestern Railroad are giving a very satisfactory performance and effect an unusually large saving in fuel.

We understand that the firemen on several railroads having immensely large locomotives have deserted the scoop and gone back to corn cutting. We are inclined to think that the most of engines now becoming common cannot be operated satisfactorily without two firemen being employed upon them.

Engineers on the Cincinnati, Hamilton & Dayton road are pleased with the new Pittsburgh engines, and write us they are shortening the distance between Indianapolis and Cincinnati considerably. They are also pulling four or five more loads on freight than before.

The German military authorities are building a large air ship of aluminum, which the designer calculates can be driven through the air at a speed of 22 miles an hour. The ship is said to have cost over $350,000.

Freight-train wrecks are very common on some railroads at present, and a large proportion of them are caused by old cars collapsing under the shocks due to the bumping of heavily loaded cars of large capacity. There is no doubt that 50-ton cars will materially reduce the cost of transporting heavy freight, but when fully loaded they act like battering rams upon the weaker and lighter cars that constitute the principal part of freight cars to-day. The period of transition to the universal use of heavier cars is going to be a little hard on many railroad companies.

A committee of the Master Mechanics' Association, consisting of S. P. Bush, H. Schlacks and William McIntosh, is investigating the subject of piston valves. The gist of the investigation is—What are the advantages found in the use of piston valves and what the disadvantages?

On and after this date, the Q & C Company will exclusively control the sale of Magnolia anti-friction metal to the railroads, both steam and electric, of the United States, Canada and Mexico.

Even in far Bombay the information contained in LOCOMOTIVE ENGINEERING has its influence. The "Talk with Firemen," by W. J. Torrance, appears in the September issue of *The Railway Times* of that city.

The greatest popular liar that is still believed in by some people is the locomotive performance sheet.

CONTENTS.

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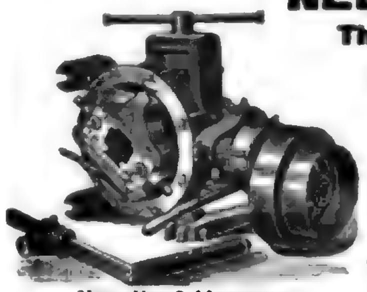

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Are among the best writings of John A. Hill.

If you read of the trials and tribulations of Skinny Skeevers when they appeared in Locomotive Engineering, you know how interesting and valuable they were. Full of pertinent suggestions and applications to everyday railroading, they contain large doses of common sense made easily digestible by liberal coating of real humor. Spicy, interesting and valuable to any railroad man, no matter what his present position.

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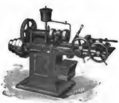

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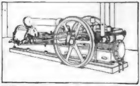

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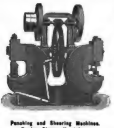

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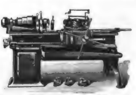

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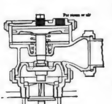

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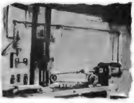

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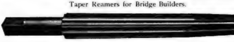

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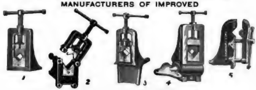

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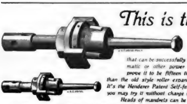

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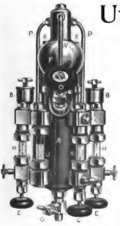

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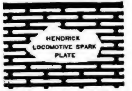

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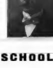

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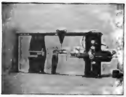

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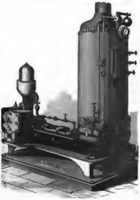

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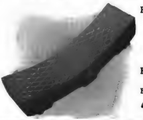

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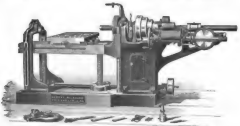

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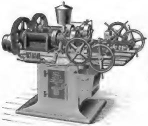

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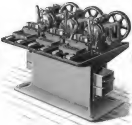

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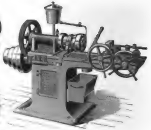

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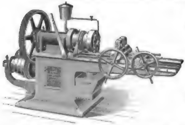

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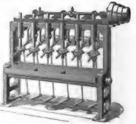

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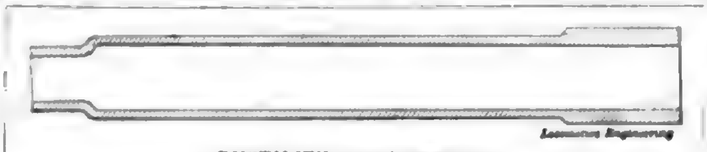

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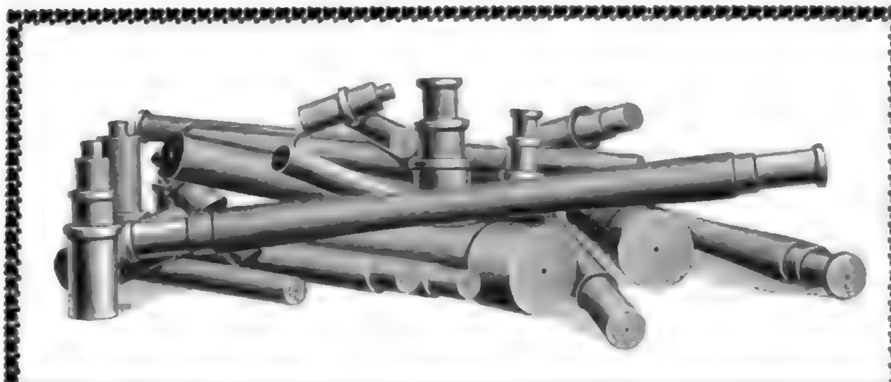

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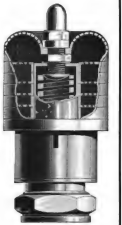

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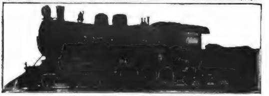

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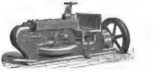

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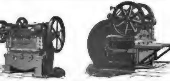

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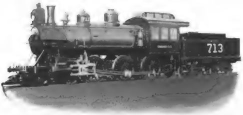

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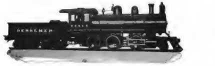

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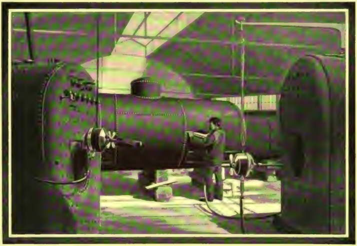

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Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XII | 95 Liberty Street, New York, December, 1899 | No. 12

An Engine Whose Drivers Were Stopped When Running Down Hill.

The engraving shown with this is one of an interesting locomotive of the Caledonian road. It is engine No. 310A, now about the last of what was once the standard passenger engine on the Scottish North Eastern, Scottish Central and Caledonian Railways. She was built by Messrs. Barclay, of Kilmarnock, in 1872, under a patent whereby, by means of a balanced lever, the driver could, when running down a bank, lift the driving wheels off the rails and let the engine coast on the leading and trailing, something after the "free wheel" fad in bicycles. Needless to say, this patent was a failure, and the attachment was, after some experiment, removed. Now, too light for main line work, she is spending her declining years on the Methven, or "Drumtochty," branch, rendered famous by Ian Maclaren in his Kailyard stories. The engine has cylinders 16½ x 22 inches, and driving wheels 7 feet in diameter. We are indebted to Mr. Sam A. Forbes, of Perth, Scotland, for both the photograph and description.

AN ENGINE WHOSE DRIVERS WERE STUCK WHEN RUNNING DOWN HILL.

A New Tunnel Over the Alps.

The Alp Mountains, which stand up as a towering barrier between Switzerland, France and Italy, are of special interest to railroad men, owing to the vast engineering work done in leading two great railways partly over the mountains and then piercing the summit with a long tunnel. The first of these tunnels, piercing Mount Cenis, was begun in 1857 and finished in 1870. It is 7 miles and 3,610 feet long. The other tunnel, the St. Gothard, opened in 1880, is 9¼ miles long, and its construction involved the overcoming of extraordinary physical obstacles. Now they are going to have another tunnel under what is known as the Simplon route. There is a famous road over this mountain which was begun in 1800, and was constructed under the direction of Napoleon. The new railway route by the Simplon gives direct communication between France, Switzerland and Milan in Northern Italy, the principal distributing point of Italian trade.

The work on the tunnel is being pushed day and night, and there is every prospect that it will be completed in the four and a half years remaining to the Jura-Simplon Railroad Company under its contract. The company has every incentive to carry out the work, if possible, in less than contract time, for it will receive an extra thousand dollars for every day it saves, while the same amount will be deducted from the price to be paid for the tunnel for every day of delay beyond the stipulated time. The work will differ from that of the Mount Cenis and St. Gothard tunnels, as there will be two tunnels, one for each line of track, the tunnels being 58 feet apart and connected every 260 feet by cross-cuttings; the present work, however, contemplates the completion of only one tunnel and a gallery through the other, the gallery being used to return cars loaded with material into the tunnel while the debris of excavation is removed through the tunnel itself.

Excavation is in progress both at the Swiss and Italian ends, and the work completed in the first six months amounted to 4,048 feet, about two-thirds of which was on the Swiss side. The statistics for the

second half year, ending this month, will show an important increase in the rate of progress. The tunnel, twelve and a half miles long, will be a fourth longer than St. Gothard and nearly a half longer than Mount Cenis, but with the improved methods of tunnelling and the better machinery now in use, the cost and the time consumed will not be commensurate with its great length.

The work on the Italian side has advanced more slowly than in Switzerland, because a large mass of gneiss has been encountered, which, even with an enormous amount of blasting, is a great obstacle in the way. On the Swiss side, however, the excavation thus far is in clay slate and is comparatively easy. The work on that side also has the advantage of the use of liquid air for blasting purposes, which has proved to be a great success in its direct effect while at the same time it does away with an unpleasant feature of ordinary blasting in tunnels, i. e., filling the air with nitrogen gas. The Italian Government has not yet given permission for the use of liquid air as an explosive and dynamite is therefore used at the south end of the works.

The temperature of the excavations is already high and is increased by the explosives. A great deal of water also oozes from the walls. The gallery is being used both for drainage purposes and to force currents of air into the tunnel. In the central portion the tunnel will be about 10,000 feet below the mountain peaks directly overhead, and the mean heat there is expected to be about 104 degrees Fahr., much too high a temperature for comfortable working. In addition to the forced air circulation it is intended, in this part of the works, to use water sprays, which, it is thought, will reduce the heat to 90 degrees Fahr.

France greatly desires the completion of the tunnel and Switzerland will derive large advantages, for it will connect the whole of western and central Switzerland with Italy. Switzerland, without a port or a mile of sea coast, occupies a high place among commercial nations because of its splendid communications with all the countries around it and with their seaports from which its products are sent to all parts of the world. The new tunnel will place Switzerland in direct relations with Milan, the third largest city of Italy, and will be its best route to Genoa, which is now rivalling Marseilles in the volume of its international shipping business. When the first tunnel is in operation side tracks will permit the passage of trains, and the second tunnel will not be completed until the increasing business requires it.

It doesn't take much slipping of an engine to cost as much as a good sander. The delay at stations, the possible blocking of the road and the wear on rails must be considered.

Why American Industries Produce Goods at Low Cost.

Mr. John Thomson, a well-known mechanical engineer, has been explaining, through the columns of *Engineering*, why American industries are able to compete with those of Great Britain, and he summarizes the facts thus:

"It is because of better organization; more complete adaptability of system; greater incentive; a higher or broader development of engineering as a profession; ready flexibility to meet new conditions, and because low-priced craftsmen in Great Britain may, and do, more quickly become high-priced master workmen or foremen or superintendents and proprietors when transferred to America."

The subject is then discussed at considerable length. A few of the salient points made are:

"Closely allied to this scheme of the matter is freedom of exercise of ambition upon the part of the operator, and measurably proportionate pay for the results obtained. This covers the great principle of incentive, and applies both to the operator and to the proprietor. Americans can in nowise claim to have reached an ideal position in this respect; but it is maintained that this principle has been carried further in America, and has produced better effects, than the system in vogue in Great Britain and elsewhere; the consequence of which is to produce an average result equal to that of the least efficient member.

"The position, as a manufacturing nation, of Great Britain is that derived from dear-bought and long-time developed experience. May it not be accepted as an axiom that that which is obtained slowly and by arduous effort will be the longer cherished and retained? Experience is the most valuable asset of civilization. It is also, too frequently, the greatest bar to progress. Pig-headedness, obtuseness and stupidity are often excused on the plea of 'experience.' It is mainly from too firmly anchored opinions that has sprung 'the conservatism which fights all innovations, simply because they contravene present ideas and practices, and against which advancement must ever contend.' On the other hand, the relatively high place occupied by the United States, in all except the heaviest classes of machinery, forgings, etc., has resulted, to a considerable degree, from successful experimentation; the consequence being a greater and better output in less time, or with less labor than is possible by old methods. It is confidently asserted, as a fact of common knowledge, that the necessity, or the desire, or the spirit, which conceives the vision of an improvement in process or method, and then promptly carries it through to a successful practical demonstration, is the most likely to be eager and ready to improve upon the improvement if the opportunity is presented. 'Every undertaking, properly executed (should) bring about improvements in the process of execution.'

"There is no doubt that the interchangeable, or, more properly, the duplicate system of construction of the component parts of machinery and structural steel members, has been carried to a higher stage of development with us than elsewhere. The contingent advantages arising from this development could hardly have been foreseen by the early promoters of the system. It undoubtedly has had much to do in generalizing the practice of paying for construction by the piece, or to base the per diem wage upon the number of parts or operations produced in a given time with given facilities. It is only by the proper carrying out of this method that the ability of the operator can be ascertained and obtained; it is only by this method, too, that the operator can obtain increased wages for the higher cultivation of his skill. Moreover, it is only by this method that the full capacity of the improved machine or special tools or fixtures can be derived.

"Thus the engineer who designs a tool whose output of a certain kind is increased over previous practice is entitled to that increase. Again, the operator who by diligence and the exercise of his ambition obtains the greater output from that tool is entitled to the larger remuneration. A really successful duplicate system of construction involves intelligent co-operation. The consequence of this co-action with us, and there has been much of it, has been a higher average of wages to the workman and a greater or a better (and hence more salable or more profitable) output for the proprietor. This would seem to come fairly close to the 'business end' of the matter."

The New Plant of the Sargent Company.

The old works of this company being entirely too small for their growing business, they have built a new plant at Chicago Heights, which is a model of its kind. In addition to their brake shoes, they will make steel castings by the Tropenas process.

The iron and steel foundries are in separate buildings, the former 80 x 200 feet, the other 50 feet wide by the same length. Between them is a court 40 feet wide, which accommodates three side tracks.

The cleaning, core, sand, cupola and molding rooms are all of ample size and equipped with the latest and best machinery for the purpose.

There are two cupolas for iron, one 60 and the other 72 inches, while both the steel cupolas are 60 inches.

Shaw electric cranes are used, and other modern appliances for handling material and cheapening production have been freely used, including Tabor molding machines and pneumatic hydraulic jib cranes and hoists.

Wages and Living on the Siberian Railway—What the Poor Russian Railroad Employés are Paid in Siberia.

BY L. LODIAN.

In central Siberia, it is only 18 rubles a month that the guardians along the line receive. That is equal to $9; but better living and more creature comforts can be got out of $5 in the United States than out of those $9, or 18p., in Siberia. The guardian's little house (called budka) is seen every three or four, sometimes five, verstas along the line. The budka is of course rent-free, as is also the firing. [A versta is 3,500 feet.—Ed.]

These guardians (called storoj) each have their length of line to look after every day—three verstas, say two American miles. They have to signal every train, using the puerile toy-trumpet or tooting-horn, as in France; and if they miss, and are caught missing, are fined 1 ruble for each omission. Then they have to carry dispatches along to the next budka, and so on the message is passed from storoj to storoj. Where, in western and central Siberia, the distance between stations is thirty-five up to as much as fifty verstas, it happens that a midway roadmaster's house is from eighteen to twenty-five verstas from the nearest telegraph station, and the only way to get a dispatch to him is by sending the message from guardian to guardian. This takes from four to six or more hours; and perhaps the message is a complaint from the "machinista"—as the locomotive engineer is termed—of heavy snow-accumulations on the section of the roadmaster to whom the missive is footed.

These dispatches give the guardians oftentimes unduly excessive walking, and some of them have complained to me that they walked from twenty to twenty-five and even thirty verstas a day—backward and forward (what with signaling trains, going twice a day over their length of line, and carrying dispatch after dispatch to the neighboring budka). It is unpleasant work at night; for they are liable to be aroused at any time, and have to quit their snug, warm rooms to walk—there and back—some four miles through a howling black night full of ice-blasts of 20 to 40 below zero.

Penof, Phot., Ekaterinburg, Siberia.

WORKMEN'S HUTS, GREAT SIBERIAN RAILROAD.

Often have I met them when out late on the line myself. Some of them carry a lantern and gun—for they are afraid of wolves here and there, although I never saw one myself during 8,000 miles of solitary travel over Russian territory. But I have heard occasionally—and these guardians also sometimes hear—an uncanny stealthy creeping in the forest near the line. I can tell you, if there's a time when a man's nerves are tested, it is when he—alone at night on the great Siberian railroad, and a score or so miles from the nearest station—hears that stealthy creeping in the black forest,—and the stealthy creeping coming nearer! For my own part, even relying as I did upon my 45 caliber revolver, I did not feel quite comfortable. When I heard that creeping, I never stopped to await developments, but pushed on to the station, revolver in hand for an emergency. In the black night, the gleam of that small-length but big-bore nickled revolver was the chief comfort I had.

At times, even the guardians I met carrying dispatches on the line in the dead of the night were startled at seeing a solitary individual approaching. "Kakoi chelo Bek eto?" ("What person this?"—literally) would be shouted ahead. "Slujba," I would answer, meaning "service," although this was not correct, because I had nothing to do with the railroad. Still, it sufficed till I got up near enough to briefly explain, and pass on. Perhaps, too, it saved a gun being turned upon me as a nocturnal marauder.

Podzarof, Phot., Blachboctok.

GRADER'S HUT, SIBERIAN RAILROAD (SUMMER TIME).

In Russia itself—that is, on the Euro-

pean side of the Ural range—the pay of the railroad employés is even worse. It ranges from 8 to 11 rubles per month only, with—like all other Russian government railroad employés—house, firing and medical service free; but neither of these is "grand chose." How the poor devil lives is a mystery to every foreigner except Lodian. Say his salary is 10 rubles a month. That means $5, United States currency. And that $5 in Russia will only purchase what $2.50 to $3 will in America.

HOW THEY LIVE.

Now, this is how the poor Russian byrrep* lives—as I have seen with my own eyes, having hundreds of times halted at his little hovel, and sometimes passed the night there. His staple article of diet is the roughest description of dark brown rye bread, rank with the odor of sourness, and mostly improperly baked; potatoes, with common kitchen grease; boiled rye sprinkled with melted grease; occasionally, hard-tack fish. As to meat, that he may have at most once a week. Of fruit, candy and other luxuries, he sees precious little. Perhaps he makes the acquaintance thereof when there is a wedding in the family. If he has a cow and fowls, he has milk and eggs part of each year. His drink is unsweetened tea—mostly made from exhausted tea—that is, former fairly good tea which has already been once used, and the refuse leaves saved and dried and mixed with cheap-grade teas at 1 to 1½ rubles the pound. It is inferior to the big-leaf tea I bought in Japan at 2 sen (2 cents) a pound.

Altogether, the life of the Russian railroad employé is, I believe, the poorest-living, hardest life of any railroad employé in crackdom.

Kruchkol, Phot., Tomck.

A CURVE ON THE GREAT SIBERIAN RAILROAD (CENTRAL SECTION), KPACHOIAPCK-TOMCK.

In Siberia the foreman receives from 30 to 35 rubles per month; in Russia, from 15 to 25 rubles. East of the Urals the roadmaster will receive from 40 to 50 rubles, in Russia from 30 to 40 rubles. Just think of it—a roadmaster, forty years of age, and after twenty years' service from platelayer up, giving his services for $15—equal to—a month! And the purchasing power of those $15 in Russia being only equal to $8, or at most $10, in the United States. Railroad navvies receive from 40 to 50 kopeks per diem (20 to 25 cents). Nearly the only thing cheap in Russia is labor. Religion—I don't mean

Gendre, Phot., Ob, Siberia.

SITE OF THE STATION AND NEW VILLAGE OF OB, CENTRAL SIBERIA.

Christianity—is also cheap. And labor, I hold, is the last thing in the world that ought to be cheap. Cheap labor brings disrespect on the worker; dear labor is always respected.

There are plenty of foreign and native firms in Russia who take advantage of this cheap labor to exploit the poor Russian toilers to the last degree of sweatism. The poor byrrepc are usually too ignorant to organize to protect themselves; and if they did, the organization would promptly be lyingly denounced by the employers to the police as a "political conspiracy," and the organizers arrested and probably sent the Ciprian way—I mean, the Siberian way.

Russia, in fact, is, after India, the happy hunting-ground for the foreign capitalist who wants to exploit cheap labor. There he can exploit the poor to his heart's content. And the exploiting can be of the most criminal type: long hours; foul, filthy and altogether unsanitary factories; just-keep-from-starvation wages; and the government always on the side of the capitalist in suppressing any attempt of the workers to organize for their betterment. Thus will the Russian authorities aid the foreigner in exploiting its own poor.

As to locomotive engineers, either in Siberia or Russia, if one makes 120 rubles monthly, at the most favorable period for mileage, he considers himself fortunate. Sixty dollars per month!—and its pur-

*This is a slang Russian word. It took me a long time to find out the meaning thereof. It originated among the Anglo-Russians in Russia, and is only vaguely understood by the Russians themselves. It means a peculiarly unfortunate or God-forsaken person. The word will not be found in any Russian or other dictionary. I have retained the Russian spelling; and, for the sake of euphony, the word is best pronounced as spelt.

chasing power equal at most to what $40 will buy in America! Moral to American railroaders: Avoid Russia.

The poor wages prevailing in Russia are due mainly to the enormous waste of time, and little or nothing done, in every branch of government service. To study the evils of paternal, government-run institutions, one should reside in Russia a couple of years.

The high cost of living is due to the protection fake. Nowhere on earth will the criminal folly of protection be seen more forcibly than in Russia. It is simply "protection" of the Russian manufacturer in thrusting his shoddy—often execrable—wares on to the Russian poor.

The Skill that Comes from Constantly Repeated Mechanical Operations.

One of the most celebrated books ever published was "The Wealth of Nations," written by Adam Smith, a hard-headed, close-reasoning Scotchman, and published first in 1776. We believe that the book mentioned had more influence on the political economy of nations than all other writings of a like nature combined. Smith was a keen observer and a deep investigator of industrial problems, and much of his advice would have greatly profited the British nation, had it been heeded. He was the first to tell about the increase of a workman's productive powers when he was continually repeating the same operation, but the practice never met with wide application until Eli Whitney, an American, extended it to armory work. In one part Smith says:

"A common smith, who, though accustomed to handle the hammer, had never been used to make nails, if, upon some particular occasion, he is obliged to attempt it, will scarce, I am assured, be able to make above two or three hundred nails in a day, and those, too, very bad ones. A smith who has been accustomed to make nails, but whose sole or principal business has not been that of a nailer, can seldom, with his utmost diligence, make more than eight hundred or a thousand nails in a day. I have seen several boys, under twenty years of age, who had never exercised any other trade but that of making nails, and who, when they exerted themselves, could make, each of them, upwards of two thousand three hundred nails in a day."

Cooke Locomotive for Wales.

The eight-wheel connected, double-ended tank engine here shown was recently built by the Cooke Locomotive and Machine Company, Paterson, N. J., for the Port Talbot Railway and Docks Company, Port Talbot, Wales.

The engine weighs 169,000 pounds in working order, of which 137,000 pounds rest on the drivers. The total wheel base is 22 feet 1 inch, 15 feet 6 inches being the driving wheel base.

The cylinders are 19 x 24 inches, and the driving wheels 52 inches in diameter. The boiler, which is of the wagon top type, is 56 inches in diameter at the smallest ring, and provides 1,489 square feet of heating surface. The firebox is 84 inches long and 42 inches wide. There are 219 tubes 2 inches in diameter and 11 feet 11 inches long. The engine has Richardson-Allen balanced valves, with a travel of 5½ inches. The steam ports are 1½ x 17 inches.

Among the special equipment of the engine are Latrobe tires, Ramsbottom safety valves, Vacuum Oil Company's cylinder lubricators, Ashcroft steam gages, Vacuum Brake Company's brake equipment, Pickering Springs, United States metallic packing, copper fireboxes, brass tubes, Davis & Metcalf's exhaust steam injectors.

COOKE EIGHT-COUPLED FOR WALES.

The Pittsburgh & Lake Erie management have recently adopted the policy of subjecting all applicants for positions in the train service to a vigorous examination for physical, mental and moral defects, at the same time charging them $1.50 for the examination. There is considerable dissatisfaction among the would-be employés of the road on account of the examination and the charge for the same, but we think that the company are perfectly justified in putting it into force. The condition of train service now requires intelligent men, and the right way to have an intelligent set of trainmen is to see that intelligent men are hired in the first place. The $1.50 charged is a small matter, but it will keep back the people who are not likely to come up to the requirements.

"Car Ferrying on the Great Lakes."

BY WALDON FAWCETT.

The ice-breaking steamer is not an American invention, but there is no doubt that it was on the great lakes which form the northern boundary of the United States that practical demonstration was first given of the usefulness of this type of vessel as connecting links in railway systems crossing great stretches of water, which it would be either impossible or too costly to bridge.

Now, we have in service on the inland seas a very respectable sized fleet of these car ferries, each of which makes several trips daily, every day in the year. Oftentimes in the winter months they are compelled to plow their way through fields of ice varying in thickness from 3 to 4 feet; but how well they withstand the exactions of this arduous service may be imagined when it is stated that when the car ferry steamer "Pere Marquette," one of the lake fleet, went into dry dock for examination in the autumn of 1899, she had traveled more than 40,000 miles without repairs.

Originally, the railroads having termini at Great Lake ports, between which it was necessary to maintain as nearly uninterrupted communication as possible, were dependent upon iron-shod ferryboats. As was inevitable, traffic was frequently interrupted during the more severe winter weather, and it was necessary to divert freight and passengers to long, roundabout hauls.

One day when one of the ferryboats was leaving an ice-bound wharf it was discovered that she made her way out better by going astern than ahead, owing to the fact that the disturbance of the water by the propeller had a disrupting influence of considerable magnitude. It was plain that if a steamer could be built with a screw at both bow and stern, she would not only have the requisite carrying capacity, but would be able to make her way through ice of almost any thickness.

D. McCool, who was at the time general superintendent of the Mackinac & Marquette Railroad, endorsed the idea at once, and finally won over President Ledyard, of the Michigan Central Railroad, who had originally opposed the scheme. The two roads mentioned and the Grand Rapids & Indiana Railroad jointly opened negotiations with the Detroit Dry Dock Company, of Detroit, for the construction of a steamer modeled on these lines, and which was designed for service in the Straits of Mackinac. The cost of the boat was originally estimated at $75,000; but as one change after another was made in the plans, the price gradually increased until it reached $285,000, at which figure the contract was closed for the steamer "St. Ignace."

A RAILWAY FERRY IN LIGHT ICE.

THE "SAINT MARIE" IN AN ICE FIELD.

The "Algomah," predecessor of the "St. Ignace," began her service in 1881, and was owned by the Mackinac Transportation Company, in which all the railroads concerned had holdings. The "Algomah" continued to make trips between the terminus of the Michigan Central and Grand Rapids & Indiana Railroads at Mackinac City and the terminus of the Duluth, South Shore & Atlantic at St. Ignace—a distance of eight miles—until 1888, in which year the business of transferring passenger trains complete and freight cars between these points was undertaken by the "St. Ignace."

The size of the new boat was more than twice the size of her predecessor, the "St. Ignace" being 235 feet in length, 52 feet beam, and of 1,200 tons burden. One feature of the original boat which was retained was the slanting prow. This had been found to be of immense service in crushing the ice, and this was, of course, all the easier with a forward propeller to suck the water from under the frozen field.

The "St. Ignace" did excellent service for five or six years, when it was found that the rapid increase of the railroad traffic necessitated a more commodious vessel. Accordingly, there was built in 1893 the powerful ice-breaking steamer, "St. Marie," a vessel which weighs more than five and a half million pounds, cost fully a third of a million dollars, and will accommodate with ease eighteen freight or passenger cars. The "St. Marie" is 305 feet in length over all, 270 feet keel and 53 feet wide. Her engines are capable of developing more than 4,500 indicated horse-power. The hull below the water-

line is of the heaviest oak construction, sheathed with ¼-inch steel.

The story of the development of the car ferry service in the Straits of Mackinac is substantially identical with that in other

THE "PERE MARQUETTE" AT DOCK.

parts of the Great Lake region. The closing years of the century find these powerful ice-breaking craft in service on all the lakes and connecting rivers. Between Detroit and Windsor, Canada, a very extensive service is maintained; but, owing to the fact that ice does not form in the Detroit River to anything like the thickness found farther north, there is no necessity for the provision of ferries of such power as the "St. Marie."

An excellent example of the class of car ferries in service on the lakes is found in the "Ann Arbor No. 3," which was constructed by the Globe Iron Works, of Cleveland, in 1898, for the Ann Arbor Railroad & Steamship Company. This steel, twin-screw vessel is 270 feet in length over all, 259 feet on the water-line, 52 feet beam, and 18 feet 6 inches in depth. The main deck is provided with four tracks and the necessary jack-screws, chain, clamps, etc., for securing twenty-two railway cars. She has two powerful engines, to which steam is supplied by four boilers, and is equipped with an electric-light plant and all modern improvements. Some idea of the bigness of the vessel may be obtained when it is stated that each of the seven compartments in the hold are sufficiently large to carry 25,000 bushels of wheat.

The efficiency of the modern type of car ferry could not have been more conclusively proven than by the service rendered by the fourteen vessels of this class on the Great Lakes during the winter of 1898-99. The unusual severity of the winter resulted in the formation of ice much heavier than the car ferries had heretofore encountered, and the ice was also found in fields of greater extent than in previous years.

One of the most remarkable achievements was that of the car ferry steamer "Pere Marquette," which succeeded in keeping navigation open all winter on Lake Michigan. The "Pere Marquette," which is one of the most powerful vessels of this type on this side of the Atlantic, was built by F. W. Wheeler & Co., of West Bay City, Mich., and is 350 feet in length, 56 feet breadth, and 36 feet 3 inches depth from keel to upper deck. When loaded with thirty freight cars this vessel displaces 4,050 tons on a draught of 12 feet 3 inches. She is capable of attaining a speed of 16 miles per hour in open water, and has a record of 10 miles per hour continuously through 14 inches of solid ice. Her route is between Ludington, Mich., and Manitowoc, Wis., a distance of 56 miles. About 3½ hours are required for the trip.

A strange feature connected with the operation of this huge ice-breaker is found in the fact that the intensely cold weather was in her favor. Ice on the east shore was for the greater portion of time frozen very hard for 15 miles out, preventing it, of course, from crowding on the shore and blocking the harbors, particularly at Ludington, Mich., which is the western terminus of the Flint & Pere Marquette Railroad. The ice on the east shore ranged from 12 inches of hard blue ice to 15 feet of snow ice where it had winrowed. The "Pere Marquette" was not over forty-eight hours in making any one trip, and ran almost uninterruptedly throughout the entire winter.

All the lake car ferries were not, however, so fortunate. The steamer "Shenango No. 1," one of two car ferry steamers built several years ago for transferring cars from Conneaut, Ohio, across Lake Erie to the Canadian shore, was particularly unfortunate. The "Shenango" is not a high-powered boat like those previously

LOADING CARS AT THE STERN.

described, and when the thermometer dropped to from 18 to 30 degrees below zero, was caught in a great field of ice, and for more than a month floated about Lake Erie with the ice piled mountain-

high around her. A portion of the crew remained on board, and made trips ashore as occasion offered for supplies and provisions. Naturally, however, these were at uncertain intervals.

Perhaps the greatest service rendered by the car ferries, however, was their assistance in the release of a great fleet of almost a hundred lake freight steamers which were caught by a sudden burst of wintry weather on their final trip of the season, and imprisoned in a vast field of ice near the head of Lake Erie. Owing to insurance complications, as well as for other reasons, the delay was costing the vessel men thousands of dollars per day; and had it not been for the assistance rendered by the car ferry steamers, which were hurriedly rushed to the scene and released the fleet, the consequences would have been serious in the extreme.

No end of attention has been attracted in Europe during the past season by the construction of several ice-breaking steamers for the use of the Russian Government. It is not generally known, however, that the Russian officials, before planning these vessels, visited the United States and made a most thorough inspec-

HARD AT IT.

tion of the car ferry steamers in service here, adopting many of the ideas embodied in the American craft.

A Little Compound Locomotive History

At a meeting of the Junior Section of the American Society of Mechanical Engineers, Mr. Fred H. Colvin, of Locomotive Engineering, presented a paper on "Compound Locomotives." Extracts of this follow:

"As the compound locomotive has weathered the storms of the experimental stage and, having proved its worth, is with us to stay, it may be interesting to see what types are in use to-day and to understand something of their workings.

"Before taking up the modern engines it is but fair to the earlier advocates and inventors to glance at their work and place the credit for ideas and designs where it belongs.

"The first compounding of a locomotive of which we have record was the design of Thomas Craddock, of England, who, in his book 'Chemistry of the Steam Engine,' published in London in 1848, describes his 'twin cylinder engine, having one valve serving for ingress and egress of steam into both cylinders. By this means he makes *one* eccentric, *one* valve, *one* cross-head and *one* connecting rod, with *one* steam box, serve both cylinders.'

"He abandoned the single crosshead idea, however, but his first actual engine connected both cylinders to one crank pin. Both the cylinders are operated by one slide valve. It is also interesting to note that he used a fan condenser, with which he claimed to have secured 18 inches of vacuum. The cylinders were 6 and 14 inches, and 115 pounds pressure was determined on, though he predicted 200 pounds in a few years.

"The first compound engines of which we have an actual record of performance were, according to F. W. Crohn, in Proc. Inst. M. E., London, 1879, the invention of Mr. John Nicholson, in 1850. The first one is said to have shown an economy of 20 per cent. in fuel (coke at that time). The ratio was 1 to 1.36. In the same year James Samuels patented a two-cylinder compound, a portion of the high-pressure exhaust going out of exhaust nozzle for blasting fire. Annular cylinders, with a ratio of 1 to 4½, were patented in England by Fraser Shelby in 1862.

"In 1867 a yard engine of the Erie Road in Buffalo, N. Y., was changed to compound according to the design of Perry Lay. This was a tandem four-cylinder engine, with cylinders 12 and 24 x 24-inch stroke, and was illustrated in the Locomotive Engineer in May, 1891. This was probably the first compound locomotive in America.

"The next we know of in actual use was by the Remingtons at Ilion, N. Y., in 1870, from the designs of William Baxter. This was a two-cylinder compound, and had an intercepting valve under control of engineer. This was a good engine and only lacked a reducing valve. Without it the engine was much more powerful on one side than the other when working simple. This also appeared in Locomotive Engineering in December, 1893.

"In 1873 William S. Hudson, of the Rogers Locomotive Works, patented a superheater for two-cylinder compounds, but we have no data of its application to a locomotive.

"Then comes Anatole Mallet, who began experimenting in 1876, and who, in June, 1879, read a paper on the subject before the Institute of Mechanical Engineers in London. He was the first to describe in this the use of a reducing valve to equalize work done when working simple, but his was not a success and he abandoned it. He should, however, have credit for the idea.

"Worsdell and Von Borries built two-cylinder compounds in 1887, with intercepting valves, which put the engine in compound as soon as the exhaust from high reaches a predetermined pressure in the receiver. These, as well as the Lindner system, use live steam in low to start, but govern the amount by wire drawing.

"The Webb compound is also a type worth a passing notice. There are either three or four cylinders, generally three, with the two high-pressure ones outside connecting with the rear drivers, and the low-pressure cylinder or cylinders between the frames connected by a cranked axle to the forward drivers. The two pair of drivers are not connected, and there are times when it is rather startling to see one pair slip and the other remain stationary, owing to low-pressure crank being on the center.

"The only engine of this type in this country was the No. 1320 of the Pennsylvania Railroad, brought here in 1889. It did good service despite its faults and the prejudice it had to contend with, and saved about 20 per cent. in fuel."

The paper then described the leading makes of compounds now in use here, including the Rhode Island, which, though not numerous, was one of the first. The charts which have appeared in this paper were used in illustrating the workings of the different compounds. In conclusion it said:

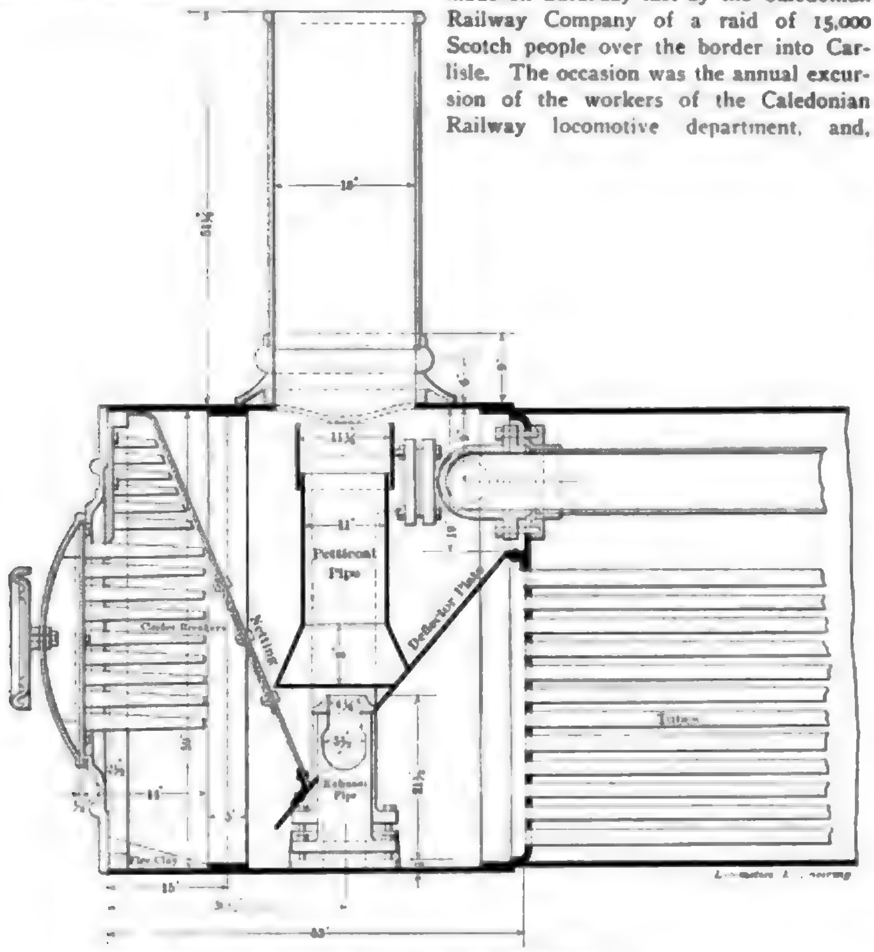
"It is often charged that two-cylinder compounds 'nose' around on account of developing more power on one side than the other, but this would seem to be largely imagination. A simple engine is always working one-sided in so far as one side is at maximum while the other is at minimum power, and it is nothing out of the usual to bring an engine in with one side uncoupled—the other doing all the work. The fallacy of one-sided working when running simple on account of large cylinders is shown by the action of reducing valve and the fact that careful tests show a variation of less than 2 per cent with careful designing. This is no more than is apt to be found on any engine after having its cylinders bored larger than the other—being simply trued up.

"The fact that a compound engine has more power when working simple than in compound is generally taken as showing that the reducing valve does not act quickly and the large cylinder gets more than its proportion of steam. That this is not the case is evident when we learn that the safety valve in the receiver passage—set to blow at the determined receiver pressure—rarely or never pops. The actual reason is that the high-pressure cylinder is relieved of its back pressure, which adds quite a little to the effective forward pressure."

There was considerable discussion as to the portion of saving due to effect of larger nozzles and more even draft on fire, or what might be credited to the boiler and that due to cylinders; also the best service for a compound.

Mr. George L. Fowler took a prominent

part in the discussion and gave much valuable information. He showed that the best results from any engine come where it has a steady pull at its economical load, and for a compound this would be a level road with its full train. It is often considered that mountain service is best for compounds, but it must be considered that it is only working going up, and is idle coming down, and is only saving fuel when working; while drifting it will probably burn more fuel than a simple engine. The economy, however, was not questioned by anyone.



SPARK BREAKER AND EXTINGUISHER.

Spark Breaker.

We present herewith a cut of the arrangement applied to the front ends of the Chicago, Indianapolis & Louisville Railway, the Monon route, to break up and pulverize the cinders, so that when they finally get to the ground after leaving the top of the stack, they will be too small to do much damage by setting fires.

The front-end deflector plate, nozzle and petticoat pipe are of the Master Mechanics' type, with a low nozzle. It is shorter than usual. Between the netting and front door in this space are a series of fingers, cast on a plate, extending close to the netting. These fingers are 14 inches long at the bottom and shorter near the top. The effect of the draft dashing the live cinders against the fingers is to break them up and kill them. Two years' trial has demonstrated the value of this device in reducing the fire claims of the road over 80 per cent. It is patented by W. P. Coburn, master mechanic.

A Great Railway Mobilization.

We, in this country, are not likely to be greatly exercised on the subject of the mobilization of troops by railway to repel an invasion of foreign troops; but it is nevertheless a satisfactory and an assuring fact to have such a demonstration as was made on Saturday last by the Caledonian Railway Company of a raid of 15,000 Scotch people over the border into Carlisle. The occasion was the annual excursion of the workers of the Caledonian Railway locomotive department, and, oddly enough, they had chosen the anniversary of Flodden. Lord Rosebery came with them, and did his best to assure the English host that it was a peaceful foray, an assurance not altogether uncalled for, since in the '45 rebellion a forbear of his lordship lost his head at Carlisle for leading the Jacobites. But our concern is with the railway mobilization, which was so admirably carried out. There were fourteen trains, each with eighteen carriages and over 1,000 passengers, so that, including passengers and engine and tender, the weight of each was 435 tons, and yet each train was taken by one of the improved Dunalastair engines, the running of which has brought so much credit to their designer, Mr. J. F. McIntosh, the locomotive superintendent of the company, as honorary president of the excursion committee, had also much to do with Saturday's arrangements. The first train left at 5:10 in the morning, and the fourteen were dispatched from St. Rollox at intervals of 10 minutes, with two exceptions, when the schedule allowed 20 minutes, so that the whole of the 15,000 passengers were sent off in 2 hours and 40 minutes. In each case 2 hours and 25 minutes were allowed for the run from Glasgow to Carlisle, and all arrived to time except the fourteenth and last, which was 15 minutes late, owing to having been delayed by a goods train in front. We do not need to recall the long climb up Beattock, nor the length of the run. The performance is a splendid one. On the return from Carlisle the trains left at different intervals to suit the excursionists; 2 hours and 30 minutes were allowed for the journey. Some of the trains arrived before scheduled time, while one or two of the later ones were handicapped by so many other trains being on the line, and did not arrive until several minutes after their booked time, but on the whole the trains may safely be said to have been run to time, as in one or two instances the trains were a minute or so late in starting from Carlisle. Each engine consumed 35 pounds of coal per mile, or a total of 1 ton 12 cwt. on the journey, so that it took 2 pounds 12 ounces of coal to carry each passenger from Glasgow to Carlisle. It is estimated that the cost of the rolling stock used in this one excursion was a little short of £200,000. The whole excursion was a great success and passed off without a single hitch or any untoward circumstance.—*Engineering.*

A curious and amusing story is being told respecting a young man who, being the chief of the auditing department of a certain railway company, had occasion recently to dictate a letter to the head of a corresponding department of another railway. There was a point in dispute between the two companies involving money, and this young official had taken the stubborn ground that the other official was totally at fault, and advanced what seemed to him unanswerable arguments to prove it. A short time after he had forwarded the letter he received an offer of a situation from the other railway company, which he accepted, and within a few days he became the head of the department with which he had been in dispute. The first letter which he found on the file ready to be answered was his own on the point in question. There was only one thing to do. He immediately dictated an answer to his own letter, refuting and repudiating its arguments, and wound up by the suggestion that the writer did not know his business! Of course, the letter was addressed to himself and signed by himself.—*Railway Herald*, London.

A New Consolidation.

This is one of two compound consolidation locomotives recently built by the Baldwin Locomotive Works for the Bavarian State Railways. The general dimensions are as follows:

Gage—4 feet 8½ inches.

Cylinders—14 and 24 x 26 inches.

Driving wheels—50 inches diameter.

Total wheel base—21 feet 8 inches.

Driving-wheel base—13 feet 5 inches.

Total weight in working order—137,370 pounds.

Weight on driving wheels—118,790 pounds.

Boiler—66 inches diameter.

Number of tubes—270.

Diameter of tubes—2 inches.

Length of tubes—12 feet 5 inches.

Length of firebox—112¼ inches.

Width of firebox—42⅝ inches.

Heating surface of firebox—158.8 square feet.

BALDWIN CONSOLIDATION FOR BAVARIAN STATE RAILWAY.

Heating surface of tubes—1,730.3 square feet.

Total heating surface—1,889.1 square feet.

Truck wheels—36 inches diameter.

Driving-wheel journals—8 x 10 inches.

Truck journals—5½ x 10 inches.

Tank capacity—4,800 gallons.

Senseless Noises on Railroads.

A speaker at a recent meeting of the Western Railway Club endeavored to interest the members in the nuisance caused by unnecessary noises of locomotives. We have frequently urged that a little less whistling and less ringing of the bell would not reduce the dangers of life and limb to railroad travelers and others, but all our preaching in this good cause seems to have availed nothing. The Chicago man said: "It will not be denied that both bell and whistle have their uses, and are, in fact, indispensable adjuncts of the locomotive. But are they not abused? Is there not a great deal of needless tooting of whistles and ringing of bells upon the locomotives in use in Chicago? Do not engineers from force of habit continue to sound their whistles at crossings where the tracks have been elevated, and hence no need of it at all? With the tracks all elevated and grade crossings abolished, why should an engineer need to use either bell or whistle while his train is going through the city?

It would seem that under present conditions in Chicago, engines upon the various roads in Chicago might be operated with much less noise than formerly. If this be true, should not the reform along these lines be started at once?

In calling attention to this subject of unnecessary noises, in so far as railroads are concerned, it has been done in no complaining or querulous spirit. It seems, from the character of men who make up this organization that you are keenly alive to all questions the discussion of which will improve the service of your lines and make them popular with the people. What has been said is meant in a spirit of helpfulness and for the ultimate good of all concerned. Your co-operation is wanted in dealing with these matters, which, as a public official, charged with the responsible duty of conserving the public health, I am sworn to give my earnest and constant attention."

Between the horrible noises made by many of the electric motors on the elevated railroads, the screaming of steam whistles and the ceaseless clanging of bells, Chicago is gaining the reputation of being about the noisiest city in the world, but the denizens of other regions have good reason to complain of unnecessary noises. Some enginemen acquire a fondness for whistle blowing and bell ringing, and they keep up the noise in places and at times where it is of no service to any-one and is painful and annoying to hundreds. The invalid and the light sleepers in many quiet homes are startled at every hour of the night with the far reaching noise of whistles and bells for which there is no excuse.

Another noise nuisance is the pop safety valve. A philosophical fireman, some of whose impressions we read lately, remarked: "The master mechanic who puts a pop valve on a locomotive that goes off like a cannon ought to get two years in the penitentiary." We think that view is sound. Another objectionable railroad noise is the slamming of doors on passenger trains. Some railroad companies equip their passenger cars with automatic door closing devices, but the majority leave that to the flagman or the passengers. When these close a door they slam it so hard that it makes a noise like a shotgun, and nervous passengers shrink as if they had been struck by a snowball. There are many other useless noises that irritate people against railroads, but if those mentioned were abated, life would be a little more worth hanging on to.

Hot Wheel Hubs.

On one of the Western railroads the eight-wheel engines drawing the passenger trains were troubled with hot boxes, caused by the excessive friction between the wheel hubs and engine truck boxes when passing around sharp curves at a high rate of speed, very little trouble being experienced on straight track.

Brass and babbitt liners, as well as changing the amount of lateral motion for the truck wheels were tried, with indifferent results. Finally the superintendent of motive power concluded to change the rigid engine truck for a swinging truck on one of the engines, and the trouble ceased at once. The other engines in this service have had swinging trucks put under them, with the best of results.

General Correspondence.

All letters in this Department must have name of author attached.

A New "Old Man".

As far back as the writer can remember (and it is a long way back) the tool known as "old man," used in ratchet drilling, was of the same shape as it is to-day. Having been put to my wits' end many a time for something to support my ratchet, the appliances in general use not being suitable for the job, an "old man" of the design shown suggested itself to me. *A A*, Figs. 1 and 2, is the post, *B* the arm, and *C* a hardened piece that will pinch on post or arm, as the case requires. The spots shown on the side of *C* are permanent centers for the feed screw of the ratchet. The curved and straight faces *E E* also have the permanent centers. The idea of the piece *C* is, that there is no position for the ratchet that one of these centers cannot be used for, thereby obviating the necessity of putting centers in the post or arm.

You will notice the lower end of the post *A* has a boss, bored out taper. The angle foot *D* also has a boss, fitting into boss on post *A*, making a male and female fit. The taper is of such a degree as will make a tight fit when drawn together by the bolt F; and the fit is not supposed to move when any reasonable pressure is exerted by the ratchet. The hole through the boss on the angle-foot *D* is square, and the end of the bolt *F* made square to fit. This prevents the post moving and slackening the nut *H*. So far as the angle-foot *D* is concerned, the post *A* has a full sweep of a complete circle.

J is a clamp to be used when required. Fig. 3 shows an adjustable brace to be used when required. The brace is secured to the post or arm by the bolts 1 and 2 passing through the hole 3. At *K* is a hinge joint to allow the brace to adjust itself. At *L* is a pinching bolt to hold cross brace in position.

I don't know why good malleable iron would not do for this tool by coring the post and arm and doing just as little machine work as possible to save the outside skin. Perhaps steel castings would be better. It is not patented.

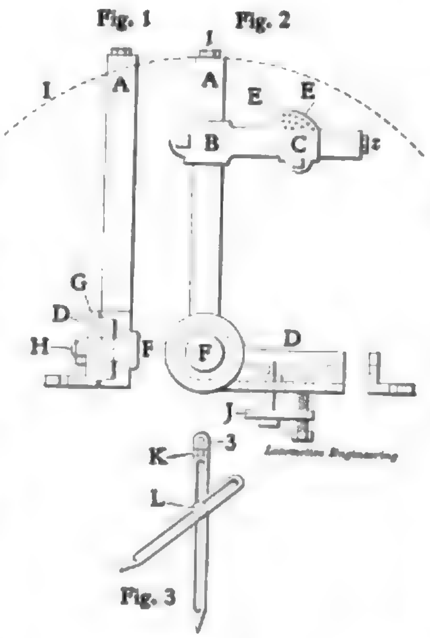
W. DE SANNO.

Kern City, Col.

Smokeless Firing.

I have fired on several different roads, using various kinds and qualities of soft coal, good and bad, and I have found by practice and observation that smokeless firing is easily accomplished when the condition of the engine is properly looked after. The nozzle must be of the proper size to suit the quality of the coal used, and the draft properly equalized so as to burn the fire evenly.

I have always obtained the best results where the engine was drafted to burn the fire about one-fourth harder in the back end than at the front end under flues. I have often fired engines which burned the fire nearly all at one end, either back or front, which caused no end of grief for all hands. This is a great detriment to smokeless firing, besides making an awful hole in the coal pile. I find by keeping as bright and even a fire as possible, closing the door after each shovelful, and carrying a fire to suit the way the engine is being worked, it keeps the smoke down to



A NEW "OLD MAN."

a minimum. It is best to carry a heavier fire with indifferent or bad coal than with good. A very important part is to keep a bright fire and look out for holes, using the hook as little as possible. I have seen a great deal of trouble with green firemen who never railroaded before. They would get on with a certain class of engineers and firemen to learn the road and firing. The fireman would, in a good many cases, hand the man the shovel and tell him to pitch in and give her h—l, and then he would lay back on the seat box, leaving the green man to get along the best way he could. This would more than likely be the wrong way, and in a short time he would have the inside of the firebox looking like a coal yard. Then the engineer would look over to the left and say as gruffly as possible: "Bill, get down there and thaw her out; that fool couldn't keep a cookstove hot." which remark serves only to get the new man badly rattled, and the chances are he don't learn much that trip. Next trip he starts out with a different engine crew, and the fireman shows him how to handle shovel and hook properly, lets him take hold, and stands down on the deck and watches him closely. He checks him when he makes a wrong move with the firing tools or fires too light or too heavy to suit the way the engine is working. He also posts him on how the water is carried on the different grades of the road, and any other information that he thinks will be of service to the man. The engineer also gives him a few words of encouragement or commendation and advice occasionally. He will stand a better chance of making a successful fireman from the beginning than to be treated like an ignoramus just because he is a green man or happens to be a stranger on the road. I think the kind of men he learns the road with has a great deal to do with his making a successful fireman, which means smokeless firing where the conditions are such as to make it possible.

R. E. WAGNER,
Fireman, P., B. & L. E. R. R.
Conneaut, Ohio.

Location of Headlight.

Editors.

In the November number of LOCOMOTIVE ENGINEERING you show a picture of a heavy Brooks locomotive, and I notice that the headlight is attached to brackets bolted to the ring of the smoke arch.

This arrangement moves the headlight away from the smokestack and the excessive heat of the smoke box when the engine is working hard, and brings it nearer the ground.

Headlights in their present location, on the top of the smoke arch, on large, heavy engines are hard to reach, either for cleaning, filling or repairing, and as a result are seldom found in first-class order.

Now, as the utility of the headlight is of great importance, how would it do to swap places with the number plate, placing it on top of the smoke arch, and the headlight where the number plate now is?

Then it could be taken care of very easily.

J. P. KELLY.
New York.

Sellers 1876 Injectors.

Taking up the Sellers self-adjusting injector of 1876, and as in the case of the Monitor, we suppose hose, tank valve and strainer to be O. K. The injector is put to work, and after working a short time it breaks and you hear the combining tube 2 jump or click, which shows that it is getting air. If the joint in the body of the injector is not tight would it make it break? If the combining tube is worn on the outside where it rests in shell, or the shell is worn, the tube will fall out of line, and if you will listen you will hear the water going with a swirling or eddying noise.

I have known of the stuffing box on screw valve 30 to leak and injector, and have also seen it packed and screwed down so tight that it threw the valve where it rested on the seat at an angle and drew air, causing it to break.

If the injector will not prime after the water gets low in the tank, or does not prime readily, the trouble is in hollow spindle being worn too large, making the jet too weak to lift readily.

It can be made to prime quickly then by shutting the steam valve at boiler and immediately pulling handle to priming position, using what steam is in the steampipe to prime it and immediately opening steam valve after it primes, when injector will go to work.

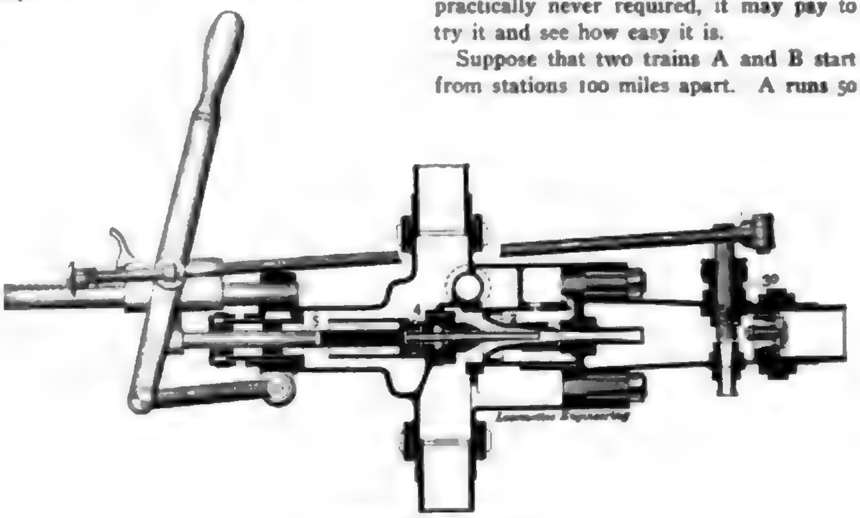
If it gets hot and won't prime, pull the overflow shut and pull the handle clear back, letting the steam blow back in tank, emptying the feed pipe and hose of water, then open the overflow and pull handle to priming position when water filling the hose and feed pipe suddenly, the water is caught on the bound and the injector is primed. The same method will apply to almost all injectors.

If the injector is shut off and steam blows out of overflow, there are only two places to grind in, either on solid spindle 5 or on valve 4. You will find an injector sometimes that will not work after priming it and pulling it clear back, but if you prime it and pull the handle back to the position that it has been almost constantly worked at, and, drawing the overflow shut, it will work all right. In that case you will find the combining tube 2 limed up so it will scarcely move, and when injector breaks you will not hear the combining tube click.

The decline of this injector is gradual, and will commence causing trouble by breaking, which finally, as the wear progresses, gets worse, and finally ceases to operate.

A. A. LINDLEY.

Oskaloosa, Iowa.



SELLERS 1876 INJECTOR.

Fireman's View of Smokeless Firing.

I have been a reader of your paper for twelve or thirteen years, and find that everyone is trying to make a good fireman and save coal and oil, do his work neatly and fire the engine without black smoke. The officials are always finding fault, but it is only the fireman they are after. The engineer is reputed to be all right.

If the fireman could have the master mechanic or traveling engineer with him every trip he would have plenty of steam and save coal. But just as soon as they are off the engine, the engineer throws the lever in the corner, pulls the throttle wide open and lets her slip till the grates lift up in the firebox. Then the fireman puts in coal and it goes right down on the grates and a clinker is made. Then the steam begins to go, and water too. The engineer looks down at the fireman and says, "Give her more coal; you are laying off." The fireman goes to spading till the next stopping place. Then the engineer gets down and looks in the firebox, and says to the fireman: "You have got too much coal in her, and a box full of clinkers." Then the engineer comes in to the foreman and says: "That fireman is no good; he can't make steam for a barber shop."

When we are running along the engineer will drop her in 12 or 15 inches for a train length and then pull her back in to 6 inches. Your fire may be in good shape for lever in 6 inches, but when 12 or 15 inches take place, big holes are cut in the fire and the steam goes. You will work and get the fire in shape again and steam up. Up she comes in 6 inches and off goes the pop. The engineer says, "You have always got her popping or else no steam." It's the fireman. He wastes the coal and oil, fills the boilers too full of water. That uses up valve oil and cuts the valves and makes all the black smoke.

I have fired now eleven years, have worked as a machinist thirteen years, and I think I know a little about how it goes on the road with engineers and firemen.

My belief is, never keep two men on an engine that can't get along together. If they agree they will work for each other's interest, and that is the company's interest. They will try and save coal, oil and waste, and get the biggest mileage. But if they hate one another, all they look for is the place to unload, and the company has got to stand the loss of coal, oil, etc.

Think of this and see if it is only the fireman. Engineers are all right in their way, but some don't weigh enough.

A. L. ECKHART.

Bloomington, Ill.

Finding the Meeting Point.

The question sometimes comes up of the meeting point of two trains which are moving at different speeds. Some formidable formulas with x, y, z's and other fixings which paralyze an engineer or shop man have been worked out for this, but in reality the question can be readily solved by anyone who can add, multiply and divide.

After studying over a formula of this kind for several minutes, I was surprised to find how simple the question really was. While in actual service this is practically never required, it may pay to try it and see how easy it is.

Suppose that two trains A and B start from stations 100 miles apart. A runs 50 miles an hour; B runs 40 miles an hour. Where will they meet, and how long after they start? Add 50 and 40 together and get 90 miles, distance covered in one hour. Divide 100 by 90 and get 1 1-9 hours as the time taken to cover the 100 miles. The distance each will run will of course equal speed multiplied by hours, and 50 times 1 1-9 = 55 5-9 miles, while 40 times 1 1-9 = 44 4-9. These added together equal the total distance of 100 miles.

If the distance is only 72 miles, and the trains run 36 and 24 miles, we have 36 + 24 = 60. Divide 72 by 60 and we get 1 1-5, or 1.2. Multiplying 36 by 1.2 we get 43.2 miles, and 24 times 1.2 = 28.8. These two make the 72 miles and show that the meeting point would be 43.2 miles from the starting point of fast train and 28.8 miles from other point. If you want the time in minutes, multiply the hours 1.2 by 60, and we have 72 minutes after leaving time for both trains.

I. B. RICH.

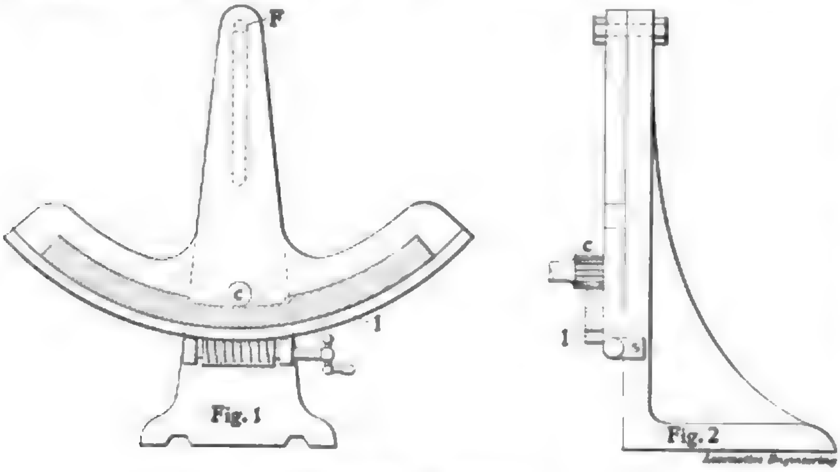
Honeybrook, Pa.

A Milling Rig for a Lathe.

In one of the shops in which I worked a number of years ago we had some peculiar packing rings for piston heads. The joints were milled so as to fit together and make a tight job, or at least that was the intention.

These joints could not be handled very well on a milling machine, and as we were not blessed with a decent one anyhow, we were not troubled on that score.

One of the ingenious chaps rigged up a fixture like the sketch, which was put on an 18-inch lathe when it was needed, and it made a very handy rig for the work. The upright, shown in Figs. 1 and 2, fitted the ways of the lathe, and was well supported; it had a vertical slot, as shown in dotted lines, so as to allow for different radius rings. There were separate front or swinging pieces for each size, each within a worm thread cut on edge for feed, and a lip *l* for supporting work. This swing arm faced the lathe spindle and the cutter *c* did the work.



MILLING RIG FOR LATHE.

It would have been easy to connect the swinging arm to a nut on the screw by a link, and then make one arm do for all sizes by blocking up to hold the work. This can be figured out by whoever wants to use it. R. E. Marks.

Camden, N. J.

Lifting Injectors Set Too High.

One of the points of economy on a locomotive that is frequently overlooked is placing the injectors too high above the water supply in the tank.

It takes power to elevate this body of water, something over 2,000 gallons per hour on an ordinary sized engine, or pretty close to 17,000 pounds raised from 2 to 6 feet every hour. This power is produced by the use of steam, and is a drain on the boiler just as much as any other steam used. Just how much this costs per hour is not so much a matter of comment as the question: Is this not a useless expense that could be avoided by setting the injectors just above the level of the water when the water is in the tank?

An injector has to be in good order to lift water very far and work to its full range of capacity. Of course, when new from the makers they will lift water right out of the pit under the engine; but it is only a short time, in some sections of the country, before the tubes are limed up and do not prime freely nor throw its full capacity when at work.

We are led to these questions by noting the location of the injectors on several prominent roads, some of which are set down as low as possible and not have the water from a full tank waste through the overflow when not working, and others set very high up; the latter give more trouble than the low ones.

But to get back to the first question: What does it cost to lift all the water used in a day on a big railroad this extra 2 to 6 feet? And is not economy in this line worth looking after just as much as in any other line? It is the little economies constantly looked after that make success.

Fort Wayne, Ind. Wm. Hartman.

Inside Injector Delivery Pipes.

In regard to the question raised in your last issue by Mr. Marks, of Camden, about piping the injector delivery pipe through the boiler to the front end inside the steam space, instead of outside, this is frequently done. It is the common practice on the Canadian Pacific Railway. Where the feed water is soft and good, it is successful. If the water is hard and full of solids which are separated by heat from the feed water, it does not work quite as well.

The check valves are fastened to the boiler head in the cab, and a pipe runs to the front end delivering the water up near the place the checks are ordinarily placed on the side of the boiler.

I have seen engines with the check valve case located on top of the boiler near the front of the cab with both injectors piped to it. With this arrangement the inside delivery pipe cannot be easily removed. When they pass through the boiler head, the joint can be opened and the pipe drawn out.

One difficulty with this inside pipe is, that it will fill up with scale faster than one on the outside. The outside pipe is comparatively cool, so very little of the scale will stick on the inside of it. Inside the boiler the conditions are quite different. The pipe passes through the hot steam and water, so the feed water is heated just as hot while passing through the pipe and deposits its scale in the pipe, which soon fills it up in a hard-water district.

If the pipe is of a generous size it may take some time for this to occur; but when it does, it must be cleaned out or the injectors will not work with full capacity.

Lagging the delivery pipe when outside the boiler will prevent the loss of much heat. John W. Troy.

Detroit, Mich.

Wash Out Kinks.

In the Western avenue engine house of the Chicago, Burlington & Quincy Railroad at Chicago there is a portable plant for washing out and filling up locomotive boilers, that is worthy of mention.

A small Worthington duplex pump is mounted on a low four-wheeled truck with suction hose to connect to the water pipe from the elevated tubs in the yard. A branch from this pipe comes up between the pits. The steam pipe runs around the entire house overhead, with branches or drop pipes between the pits. The steam end of the pump is connected to this pipe; 100 pounds of steam is carried when washing out, and a lower pressure at other times. The steam exhaust from the pump is piped to the other end into the suction, thus doing away with the steam in the house and utilizing the heat in the wash-out water. There is about 20 pounds pressure in the suction hose from the elevated tanks. With the steam pump a very high pressure can be obtained when needed. In addition to the heat from the exhaust steam of the pump, there is a steam pipe connected to the water-pipe valve at the floor, by which the water can be heated very hot when filling up the boiler, and thus have a hot boiler when fire is lighted—quite a saving of boilers, as well as time of the engine. Hot-water valves are used in the pump, so they never stick at any temperature.

Chicago, Ill. James Raymond

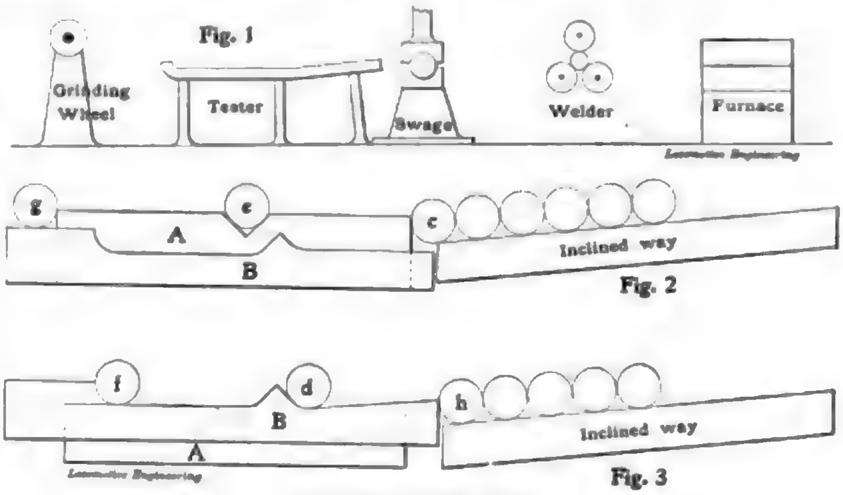
The Union Pacific Railroad people, who have nearly all their locomotives equipped with diamond smokestacks, are putting extension fronts upon all their passenger engines. The particular extension front in most favor is called the Turner, and originated somewhere in Colorado. If the father will send particulars of his paternity, with blueprint and particulars concerning his ideas of what an extension front ought to be and do, we will publish them.

Handling Boiler Tubes.

One of the neatest plants for handling boiler tubes in a repair shop seen recently is at the West Philadelphia shops of the Pennsylvania Railroad, and is, we understand, due to Mr. William B. Norris, general foreman of these shops. The outline sketch in Fig. 1 gives an idea of the arrangement, and beginning with the furnace at the left we have the welder, consisting of three rolls and a mandrel, which welds on the end.

The swage shown next is a small power-hammer arrangement; while next comes the testing machine, which is of novel design. The tubes are laid on the inclined rolling way and go against the end of block *A*, as shown at *c*, Fig. 2. There are two of these supports or blocks *A* and *B*, separated by 6 or 8 feet. The tube *e* is in the center position, and ready to be tested. The block *A*, and in fact all of the surfaces are inclined slightly, so that tubes will roll away as soon as released.

The piece *B*, or lifter, is normally dropped, as in Fig. 2, but is raised by air. It operates as follows: With tubes on inclined way, as in Fig. 2, the tube *c* stops against end of block *A*. Piece *B* rises and lifts *c*, allowing it to roll along to point on *B*, as at *d*. End of piece *B* stops next tube, as at *h*. When *B* drops, as it does immediately, tube *d* drops into *e*, and is tested, while tubes roll down against *A* again, as at *c*. The next rise of *B*, after tube is tested, rolls this tube to *f*, while the others advance one step each, the next one dropping into position for testing. The second drop of *B* allows tube *f* to roll off on to the next inclined way, and it is then in position for grinding at the wheel shown in Fig. 1. It is a very neat device and does the work rapidly.



HANDLING BOILER TUBES.

The Car Inspector.

At a farewell banquet given to Mr. J. N. Barr on his leaving the Chicago, Milwaukee & St. Paul, Mr. T. R. Morris, foreman of car repairs, among other things said:

"One of the most important men of the car department on the road is the car inspector; I think I can say he is the most important. I am a great friend of the car inspector, and think he is not appreciated as he should be. Almost any railroad man, if it is put squarely to him, will acknowledge that the inspector is a very necessary part of the machine; but they cannot 'enthuse' over him; there is no halo around his head. The engineer wears the halo. I do not want to detract any from the honor of the engineer; but when he has made a good run with forty or fifty cars of assorted sizes, ages and builds, and has brought his train safely through to the terminal, I want to see the inspector get a little of the credit for it. Do not give all the praise to the engineer. The car inspector made this good run possible by seeing that the wheels were all safe, the boxes well packed, the brakes in good order, the drawbars sound, and various other parts in shape to stand the strain of a fast run. I think the records will show the percentage of wrecks due to negligence of the car inspector is very small indeed.

"He is not usually a thing of beauty, and sometimes his language has a foreign twang, but his eye is in the right place.

"The car-department employé on the road is in a position to be of great assistance to the head of his department, if he will take advantage of his opportunities and report intelligently the results of his observations. He sees the cars in actual service, knows the value of different devices, and while he cannot, perhaps, explain in scientific terms the reasons for certain actions, his information is such as will enable him to know what will follow under certain conditions, and to prepare for the emergency. He is very often compelled to make repairs with few and primitive tools and any material that he can pick up. Perhaps a train of important freight is waiting for the car he is working on and the conductor is impatient to get away; he makes temporary repairs, it may be, but his judgment in regard to safety of the work must be good.

"The man who goes out from a terminal to fix a car set out at some small station on account of bad order, has much to contend with.

"The freight conductor who boasts of having run a train for ten years on the P. D. Q. road, eight or nine years on the A. B. C. Short Line and a number of years on each of two or three others, perhaps is the cause of a good deal of trouble to us. In his case the old saying of 'A little learning is a dangerous thing' is exemplified very forcibly. He might at one time have known a little about the construction of a car, but in his opinion he knew it all, and he took such pride in his knowledge that he was unwilling to learn anything new, as this would, in his way of thinking, be an admission that there were some things that he did not know all about before. He is the man who sets out a bad order car and wires the train-despatcher a list of defects, using technical terms that would swamp the Master Car Builders' dictionary. Words which to the unitiated are mysterious, have a charm for him. 'Needle beam,' 'rocker iron' are good words, and he applies them indiscriminately. He likes to talk about a sprung journal, though I doubt that he ever saw one, and every one of the 115 different makes of Master Car Builder couplers are Janneys. If his directions were followed there never would be another hot box on the road. He has nothing but contempt for the repairer who goes out on the road to fix a hot box on a car he has set out, notwithstanding the fact that the despised car-tinker puts the car in shape to run in about one-half the time the conductor wasted on it.

"A man of his stamp was probably responsible for a message that once came to us at Chicago, which stated that a coach was set out at a certain station, with a truck bolster broken. Not having a bolster of the kind required on hand, we hurriedly framed one and sent men out on the first passenger train to make necessary repairs. When they examined the car for the broken bolster they failed to find it, but found instead a cracked equalizer, which, however, did not prevent the car coming to Chicago by freight train without repairs being made.

"From ten to fifteen years ago the overloading of cars kept the car men at terminal points busy watching to prevent their breaking down, due to excessive load. At that time a 60,000-pound capacity car was an exception, and a 40,000-pound was the largest in general use. We have very little of this now, as a 60,000-pound capacity is the smallest built. You are all familiar with the small white cards put on new cars at West Milwaukee. They are placed near the capacity mark, and instruct the shipper not to load above

one-half the capacity until ten days after the stenciled date.

"A few months ago I was talking with a lumber dealer located in Northern Wisconsin, and we had occasion to refer to the new box cars that this company was then building. He said he was much pleased with them, as he could get a good load of lumber in them, and remarked he had had one in his yard a short time before, that had been out of the shops only two days. I told him I hoped he had noticed the white card, and put a small load in the car. He replied he could not afford to send a car out with half a load, and, not wishing to disobey instructions, held the car in his yard eight days, until the time limit had expired, and then loaded it to its full capacity."

Mr. W. F. Cleveland, whose letter in regard to the lagging of valves was published in the November issue, writes that he was only considering high speed, as the momentum of valve hardly counts at low speeds.

SWEDISH PASSENGER ENGINE, BUILT BY NYDKVIST & HOLM, TROLLHATTAN, SWEDEN.

Stiffer Drawbar Springs.

In the onward march of progress and improvement in locomotive building, larger and more powerful locomotives are coming into service every day. This is the only kind of power that can handle freight profitably, for there is no profit or even enough revenue to meet the operating expenses in a short freight train on one of the trunk lines, and it takes powerful engines to move long and heavy trains.

But at the same time there are thousands of cars in service whose draft springs and draft rigging are not of a character to stand the tremendous strains put upon them when placed next to these heavy engines. The power required to compress an ordinary draft spring is not far from 16,000 pounds; a few of the later patterns come up close to 20,000 pounds. As soon as this spring is compressed solid, it might as well be a solid washer as far as relieving the direct strain on the draft rigging is concerned.

Now, an ordinary ten-wheel freight engine carrying 200 pounds of steam, with 18 x 24 cylinders and drivers 60 inches in diameter outside the tires, has a tractive force of 22,000 pounds, which will close up the draft springs solid at the head end of the train, and the springs for some distance from the head of the train will be closed up solid also.

When a heavy train pulls out past you, look at the drawbars as the cars go by, and you will see that it is quite a ways back on the train before you see one that does not seem to be out solid. You must get back to a car where the resistance to being pulled is less than the stiffness of the drawbar springs.

A practical illustration of this can be given by taking several spring balances such as are used for weighing small weights, hooking them together tandem style in a string, pulling at one end till the scale shows a strain of 16 pounds, when all the other scales will show a pull of 16 lbs. also.

Now, a point that interests the engineer who is drawing the train, and the trainman who is watching to see that it does not suffer from a break in two, is, should not the strength of the drawbar springs be increased in proportion as the tractive force of the locomotive has been increased in the new equipment being built? This will relieve the strain on the draft gear and make a more elastic train to handle.

Some day soon all the drawbars will be of the Master Car Builder type, which makes such a close coupling that the spring slack will be about all there is in a train. When the Master Car Builder type was first adopted it was popularly supposed that an engine could not start as many cars with this type as with the link and pin couplings, but experience showed that the spring slack with the light engines and cars of that day was sufficient to help out in starting the train. Now it will not help out so much. The tractive force of the engines has increased to over 50,000 pounds in the case of a few of the largest locomotives. This is equalled, and in some cases exceeded, by the power of the two engines used in double-heading on many trunk lines.

The springs cannot have much more travel while being compressed to their full extent than the ones now in use, or it will interfere with the operation of the air brake, by allowing the hose to stretch apart, so as to start small leaks.

Of course, cars of uncertain age and limited strength will soon be pulled to pieces when they are placed next the big engines, and this will be a menace to safety of the train. Get the big, new cars next the big, new engines.

"Why in thunder do you handle those brakes so hard?" demanded a wrathy road foreman of a German engineer who held a reputation for being "a stiff braker" and for "tearin' things up." "Vy!" replied the surprised driver, "I dink I handle him easy. I only pull him on mit one handt."

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Indexes for 1899.

The index for 1899 will be ready for distribution about December 20. Anyone wanting a copy can secure one on request.

Draft Appliances and Extended Smokeboxes.

The development of the different parts of the locomotive from the most primitive form to the shapes and dimensions that are the most simple, durable, efficient, and hence the proper forms of use, presents remarkably interesting subjects of study. None of these divisions of locomotive development presents more curious phases of study than that of locomotive draft appliances. In a paper by the well-known engineering expert, Mr. Snowden Bell, presented to the Western Railway Club, on "Locomotive Front Ends," an excellent history is given of the principal appliances used for draft inducing and spark arresting purposes. Unfortunately, there is a natural conflict between devices designed to promote free draft and those intended to prevent spark throwing; and the conflict between the free passage of fuel gases from the firebox to the atmosphere and the obstructions put in to prevent these gases from carrying cinders along has led to the multitude of inventions that have been applied to the front end of locomotives.

Locomotives had been in use a long time before designers and master mechanics recognized the importance for an economical standpoint of having the draft appliances arranged in the manner most conducive to the economical use of fuel, the free working of the engine and restriction of spark throwing. No practical arrangement has yet been produced which would entirely prevent spark throwing. We have seen a few devices that prevented spark throwing, but they also prevented the engine from steaming freely enough to pull a train.

The pioneer builders of locomotives made the arrangements for carrying off the smoke and gases after the designs in use with stationary boilers. At first it was merely a chimney with a widened base to form a smokebox. The steam exhaust pipe was turned for convenience into the chimney, and it was accidentally discovered that the exhaust steam produced an artificial draft that stimulated the fire. Peter Cooper, Ross Winan, Phineas Davis, and other pioneer builders of American locomotives, considered that fans should be used to stimulate the draft in a locomotive furnace, and the same views were shared by Ericsson, Hedley, Stephenson and other pioneers in the development of the British locomotive. It was only by experiment and experience that the merits of draft induced by exhaust steam came to be recognized. The simplicity of this method of inducing draft naturally appealed to the good sense of engineers, and it was almost universally adopted on both sides of the Atlantic about the same time. A conspicuous exception was the Baltimore & Ohio, whose mechanical officials adhered to the fan for several years. They preferred the annoyance incident to the operating of a fan on a locomotive to the drawbacks of back piston pressure due to contracted nozzles, but they eventually chose the back pressure as the lesser of two evils.

For many years no attempt was made to ascertain the best relative sizes of smokebox, smokestack and exhaust nozzle. The smokebox was made about the same length as the cylinder, the smokestack a little less than the diameter of the cylinder, and the nozzle as large as possible consistent with free steaming. Until quite recently all European locomotives have had no draft regulating appliances in the smoke box, and the tubes have to be cleared of cinders at the end of each run. There are very few locomotives in Europe equipped with spark arresters.

The spark arrester and the devices intended to regulate the draft evenly through all the tubes originated and were developed in connection with American locomotives. The necessity for spark arresters arose when wood was used as fuel, and that was almost from the beginning of locomotive history. Mr. Bell tells us that early spark arrester history is mainly the recital of a series of failures. The first spark arrester was a cap of netting connected to a widened top of an otherwise open stack. The next step was putting in a cone or deflector beneath the netting. The netting and the cone were the elements of nearly all the spark arresters located in the smokestack. There have been hundreds of spark-arresting smokestacks patented, but the cone and netting that both came on the suggestion of necessity and were not patented were the most meritorious features of all of them. There were wonderful attachments added to perfect the work of the cone and netting, and their principal success was in obstructing the draft so that the nozzles had to be reduced to a ridiculous extent to force the fire gases through the obstructions.

The next valuable addition to locomotive draft appliances, the petticoat pipe or lift pipe, was given to railroads by an unknown inventor. That was the first successful appliance invented to regulate the flow of the fire gases, so that it should be uniform through the whole of the tubes. It went through many modifications of form, but proved one of the most valuable devices put upon a locomotive. About the time that the petticoat pipe began to spread into use, Isaac Dripps, of the Camden & Amboy, is said to have invented the deflecting plate. Years before that J. McIlwain applied to a locomotive smokebox a shed of wire netting which sloped from over the upper row of flues to the bottom of the smokebox in front. This netting and the deflecting plate constituted the essential elements of the arrangement of spark arresting in connection with an extended smokebox and open stack.

The extended smokebox was patented by John Thompson, of East Boston, then master mechanic of the Eastern Railroad in 1860. His patent did not embrace a netting or other spark-arresting appliance, but claimed that by extending the smokebox about 18 inches the sparks drawn through the flues are deposited by gravity in the front end and remain there. Mr. Thompson stated that the extended smokebox had been thoroughly tested on seven locomotives, and was found successful. Other railroads did not find that the plain extended smokebox was a spark arrester, but various master mechanics, especially in New England, got experimenting with it in a tentative fashion. The open stack was recognized as a good feature, for it enabled the exhaust to throw the sparks high in the air and the smoke was forced far enough upwards that it did not trail upon the roofs of the cars, which was a good thing with a passenger train. This peculiarity was what forced the extended smokebox into popular favor.

But its day of triumph came slowly. The

netting was applied by one, and various forms of deflectors by others, but its progress into favor was very slow. Fifteen years after the patent was granted to Mr. Thompson the principal spark-arresting devices in use were the bonnet stack for wood-burning, and the diamond stack for coal-burning locomotives.

The New York, New Haven & Hartford began to use the extended front on many engines, and Mr. Hill, master mechanic of the Camden & Amboy in 1876, reported very favorably to the Railway Master Mechanics' Association. As the Camden & Amboy was part of the Pennsylvania Railroad, the officials no doubt were kept advised about the merits of the extension smokebox. After trials with a few locomotives, this railroad company adopted the extended smokebox, and nearly all the other rairoads in the country got tumbling over each other in the wild rush to apply the extended smokebox to their engines. The thing became the latest fad and fashion, and no more investigation was made of its merits than there generally is into the merits or value of a new fashion of a man's coat or of a lady's bonnet.

Years ago the celebrated engineers, D. K. Clark and Zera Colburn, had carefully investigated the proper proportion of different parts of locomotives, among them the cubical content of smokebox that would produce the best results in relation to size of firebox and boiler. Those familiar with the philosophy of locomotive engineering soon noticed that most of the extended smokeboxes were too large for producing the best draft from the slowest exhaust steam velocity. To create the necessary draft to make steam with a large volume of smokebox, the velocity of the exhaust steam had to be accelerated by contracting the nozzle. When this was pointed out to the adopters of huge smokeboxes they generally wanted to talk on some other subject.

As years went on, however, the extended smokebox began to fall into disrepute, and committees of the Railway Master Mechanics' Association were repeatedly appointed to investigate the subject. One which reported favored reducing the length of the smokebox, and took the ground that the smokebox could not be regarded as a receptacle capable of carrying all the cinders during a trip. The form of smokebox found most satisfactory was elaborately illustrated and described, and the indications are that railroad companies are returning to a smaller size of smokebox. The Pennsylvania Railroad is moving in this direction, and others will lose no time in following that lead.

One of the questions that master mechanics are asking themselves is, "How much larger locomotives can we run economically?" It is quite a problem, but most of them feel that the limit has not been reached.

Light in Shops and Drawing Rooms.

The great improvement over old conditions in lighting shops impresses anyone when he recalls the dingy walls, the dark, dusty rafters and the gloomy ceiling we used to know. These seemed to absorb every ray of light that struggled through the equally dirty windows, and the "portable gas," in the shape of smoky torches, had to be resorted to early in the day. Now all is changed, and without much exaggeration we might call it the "age of whitewash," for that humble servant has become recognized at its true value.

This change has come from two causes —the recognition of the necessity for light shops and the advent of the pneumatic painting machine, which has supplanted the negro and his brush. The acknowledged necessity for more light would have had hard work to obtain the money needed by the old method; but the whitewash sprayer solves this problem very satisfactorily.

No shop with an air compressor has much excuse for not whitewashing frequently, and it is to their credit that they are not looking for excuses. They realize the necessity, and the percentage of light shops is on the increase.

The question of windows is somewhat different, and it is still a problem to keep them fairly clean—this being a case where whitewash will hardly answer. The dust can be blown off by an air jet, and it is probably practical to wash the windows with a spray of soap and water; but water flying and spattering does not find favor in any shop. Luxfer or other prisms increase the light in any building by—roughly speaking—gathering the rays near the window and projecting them into the room. The question of dirt remains, however; but is claimed to not seriously affect them.

At the Schenectady Locomotive Works they are using ribbed glass quite extensively. This has a series of fine ribs on one side and is plain on the other. It has somewhat the appearance of ground glass at a little distance.

Three years' use of this in their shop was so satisfactory that it was used in their new drawing room as well. This is about 40 by 70 feet, having windows on each side and one end. The ribbed glass diffuses the light, so that strong shadows are avoided and the light in the center of the room—20 feet from either window—is better than with ordinary window glass. The natural impression that considerable light must be excluded does not seem to be borne out in practice. They also have eight new inclosed arc lamps of 800 candle power each, fitted with large porcelain reflectors. These are giving excellent satisfaction and make a remarkably well-lighted room.

The General Electric Company, also in Schenectady, have adopted the translucent fabric for skylights and all places where it can be used. The effect is much the same as that of ribbed glass, and the light is nicely diffused throughout the room or building. For skylight in particular it is preferable on account of shutting out the glaring light that plain glass would admit.

In designing buildings for shop or other industrial purposes the question of windows and skylights is an important one, and the artistic ideas of the architect should not be allowed to interfere too much with this. An instance comes to mind where the windows on the top floor were made 3 feet shorter than was necessary, to please the architect, and it was always regretted that he was not killed on the spot. May the number of clean windows and the whitewashing of walls be materially increased, as both denote progress.

The Wide Firebox.

The wide fireboxes extending over the driving wheels seem to be getting a very good foothold in the Eastern States, and it would not be at all surprising if, later on, they will be tried again in the West, where the conditions of the fuel and water supply will allow. Some years ago a number of engines with this type of boiler went West; but they were not a success, and no more were ordered. The trouble then was said to be that the crown sheet was so close to the grate that the flame from a free-burning bituminous coal had an injurious effect on the sheet; also that the unequal expansion and contraction of the large sheets strained them, starting leaks which were more difficult to handle than in a deep box.

Primarily, the large grate surface of this type gives a chance to burn a quality of coal that is a drug in the East and of very little commercial value, and which cannot be burned at all in a narrow and deep box. If there is a supply of such coal available in the West, the use of this box would be in the line of economy in fuel bills, as it can burn a cheaper grade of fuel, and does not waste as large a percentage as a small grate surface will. The draft on the fire can be much softer. This does not tear the fire in holes and waste the heat already made, by allowing cold air to pass through; fewer live cinders are thrown out of the stack, with a consequent decrease in fire claims—an expensive item on many railroads. A soft exhaust means less back pressure against the piston at high speeds.

This type of boilers has one important qualification—they are excellent steamers, possibly on account of the larger proportion of crown sheet heating surface in the total heating surface. A firebox that is wide at the grate surface and gets narrower towards the top will have a better circulation of water to the hot sheets than the other type, for this shape allows the steam to rise without interfering with the course of the water flowing in on the sheet, something we are not so sure of in

the standard type of firebox, narrow at the grates and increasing in width higher up. As it has advantages in the line of increased steam production, it will hold its own where boiler power is necessary, as in the later designs of locomotives everything else is considered, in a measure, secondary to boiler power.

Grinding Shop Tools.

In the old days every man ground his own tools, or rather the tools he used, and each had a peculiar turn or angle which, in his eyes, made them cut better than any other tool in the shop. This included everything, from drills to milling cutters, and resulted in a great variety of shapes and sizes. It also took considerable of each man's time, and did not improve the condition of such tools as drills (flat or twist), milling cutters or reamers.

The drill grinder has long been a part of nearly every tool room, and no one will deny that drills are ground more uniformly and at less expense than by the old way. They also do better work, as the cutting angle is correct, and, being even, they drill true to size.

The grinder for reamers and milling cutters is also making its way, and the lathe and planer tool grinder is the problem in many shops at present. Some have adopted it and are using it with success—others have tried it and are either using it in a half-hearted way, and are not getting all there is out of it, while some have abandoned it altogether and call it a failure.

Its success in large machine shops, however, shows that it can be made a paying investment, while the results obtained in some of the large railroad shops show that it is applicable to this work as well as to any other. The problem is in its application and in deciding when it will pay to introduce the new system. This decided, the next thing is to determine to use it successfully by adhering strictly to the suggestions of the makers.

It is sometimes objected that it takes longer to set the machine and grind a tool than to do it by hand, and the objection shows that the proper use of the tool grinder is not understood in this case.

Having the grinder, get all the lathe and planer tools in the tool room. Grind all the turning tools to the form you select for that kind of tool, and carry this through them all. Have enough of each kind so you always have a supply, and keep them in the tool room, subject to call. They should be ground in as large lots as possible, as it reduces cost by avoiding setting the machine so often.

When a tool is dull, let it be brought (or sent in a large shop) to the tool room and exchanged for another—the dull ones can be ground when enough have collected. Two or three can be issued at once to avoid delay between tools, and the machines kept constantly at work.

The main difficulty in introducing this seems to be in not doing it entirely according to the ideas under which it was designed to work, or of trying to compromise the old with the new. With each man going to the grinder, setting it and grinding his tools, it becomes an expensive tool, although still having the advantage of uniformity. But with all the tools of the shop ground by one man—or more if necessary—there should be an increase in production. And unless the system is thoroughly carried out, there is little use in buying a grinder, for, like many other tools, they can save or lose money according to the way they are used.

Advantage of Good Tools on Repair Work.

For the time being the days of pinching poverty have passed away from railroads, and managers as a rule are not stricken with resentment or panic when the head of their mechanical department puts in a requisition for a new tool. Those concerned ought to profit by the opportunity that has come to them, and put as many modern tools as possible in their shops to replace those that have earned their place in the scrap heap. We do not know of any department of mechanical industry, except the small country town jobbing shop, that prolongs the life of a tool to the extent that it is done in a railroad shop where the heads of the company are eternally pleading poverty. In the management of companies the rules of life that apply to individuals hold fairly good. Poverty is due in a great measure to mismanagement. The individual who purchases everything of the cheapest kind, and does not buy anything till the want of it has become pressing, is not likely to be prosperous in life. In like manner the manager of a corporation that follows a similar policy upon a larger scale is almost certain to keep his employers poor and their property in bad condition.

What was once one of the most prosperous railway corporations in the United States was brought to the hands of a receiver primarily because its management fell into the hands of men who followed the policy of clinging to the practices, the tools and the equipment that had been used when the road was working itself upward. The men who used the tools and practices that were modern twenty years earlier knew their business and would probably have changed their ways when conditions changed; but they passed away and men took charge who knew nothing outside the traditions of their fathers.

It is well known that a manufacturer who has to meet competition in the open market is compelled to use the very best and most developed tools known to his line of business. The grim tyranny of unrestricted competition is compelling railroad companies to transport passengers and freight on a very slim margin of profit, yet a great many of the managers ignore the opportunity to keep down the cost of repairs by using the best tools and the best methods for doing the work. It is not long ago that the head of the mechanical department made the statement in a public meeting that first-class tools were not necessary in doing repairs to railroad rolling stock. That man is either too much dominated by the cheese-paring policy that is sometimes encouraged by those who pass or reject requisitions, and wanted to make believe that he enjoyed snubbing, or he was the worst kind of a back number.

The repairing of locomotives takes from 20 to 30 per cent. of the expense per mile of operating the locomotives. With the very best kind of tools and methods this might be reduced from 20 to 25 per cent. The season of prosperity is the season in which to introduce the means of reducing expenses in a proper way. Those who follow this policy will find it exerting good influence when the inevitable hard times come round again.

Learning From Each Other.

It is said by those who are in a position to know, that the firemen who are separated from the engineers by the wide fireboxes of the Wootten boilers do not, as a rule, pick up information about the details of running a locomotive and handling a train anywhere as accurately or as fully as when the men are working on the same deck.

We have no reason to doubt this statement, if we confine it to the case of a man who does not try to inform himself on the details of work which at some future time he may be called upon to do. But for the bright, pushing fireman who looks forward to something better in the way of promotion to an engineer, we hardly think the rule will hold good.

Constant association with the engineer whose equal in position you aspire to be some day no doubt encourages a desire to learn how the work can be done, but there are other sources of information ready for you as fast as you can use the knowledge. Acquiring one piece of information brings about a desire for more, and it is an old axiom that "Learning one fact begets a love for two more."

When an engineer sees that you are honestly trying to perfect yourself in the work of a fireman, and are successful, he should, and will, take an interest in showing you how other operations in practical railroading are conducted.

But you must not depend wholly on someone else going out of their line to furnish you all this information; you must hustle after it yourself. There are mechanical books and papers within the reach of any beginner, which will instruct in up-to-date methods. These books and mechanical papers must be studied thoroughly, however, to do you any good; reading

them over in an evening as you would a daily paper or a novel, will do very little to inform you permanently.

There is a prejudice against learning any locomotive practice out of a book; but a fair share of our learning nowadays comes out of books. Our common schools, which are the pride of civilization, use text books in a great measure to fit us for our places as business men and good citizens. Text books on mechanical subjects can be used to still greater advantage in the school which the fireman graduates from when he is promoted to engineer.

If it is an advantage to have someone who can instruct you, talk to you on practical subjects day by day while on duty, he can talk to you from the pages of a text book at a time when your mind is not busy with the duties of the trip, but wholly devoted to the subject treated of.

What the instructor says to you from the printed page is the same every time you read it; what he says to you with his voice may be misunderstood or forgotten, but the printed page can be your companion.

Of course, LOCOMOTIVE ENGINEERING, which is a standard text book on locomotive operations in which practical men do the instructing, stands ready to help out all who call on it.

BOOK NOTICES.

"Machine Tools." William Sellers & Co., Philadelphia.

Although this is issued as a trade publication—a catalogue, in other words—it deserves the attention of those engaged in shop management or shop work, as it shows some of the most modern machine tools. Opening at page 121, we find a description of their universal tool grinder, and find nine pages devoted to these machines and the tools they grind. This is a live subject, and the information here given is valuable, as it is good authority. There are boiler shell drilling machines, special tools for drilling connecting rods and similar work, car-wheel borers, boring mills, cylinder borers, wheel lathes, slotters, planers, etc., etc., each having points of its own for the careful consideration of the practical man. The 354 pages of the book are nicely printed, carefully and profusely illustrated, and the whole bound into a substantial volume. The Emery testing machines, well known in testing material, are also described and shown. Those who wish to keep posted on the latest developments of machine tools, traveling cranes, turntables and other tools should correspond with William Sellers & Co. in regard to obtaining one of these catalogues.

"The Use of the Slide Rule." By Frederick A. Halsey. Published by D. Van Nostrand Company, New York. 50 cents.

The use of the slide rule for a large portion of our calculations would lessen the labor to a marked extent, if engineers and draftsmen would take the time to become familiar with the instrument. This is particularly true of tabular work. Too many of the instruction books take the student through a mass of detail which this little book shows to be unnecessary, and also give a series of slide-rule gymnastics to tell the price of butter in Omaha if bacon is 13 cents a pound in Chicago, or some equally interesting problem. Instead of this the author gives simple exercises which give the user facility in using the instrument and which show him when he is right. Easy work is given until one is sure of himself, and then the actual problems are given without any tricks as before mentioned. Mr. Halsey also departs from the usual plan of using alleged illustrations, which usually bear little resemblance to the actual rule and confuse the student, and instead has had the rule photographed while set to solve different problems. This shows the rule as it actually appears and at once gives confidence to the user. Most of the matter originally appeared in the "American Machinist," but has been revised for this book. We have no hesitation in recommending the book as the best yet published on this subject, and feel that the slide rule deserves to be better known.

Engineer Gets a Gold Watch.

There was an interesting scene in the offices of General Superintendent William Gibson, of the Baltimore & Ohio, recently, when Engineer John F. Haggerty was presented with a gold watch and chain, as fine as money can buy, as a testimonial to his steadfastness to the company and his presence of mind in saving a trainload of passengers from a disastrous wreck. The watch bears the inscription, "The Baltimore & Ohio Railroad Company to John F. Haggerty, testifying to his fidelity at Connellsville, Pa., September 6, 1899."

General Superintendent William Gibson made the presentation with the good grace of a practical railroader Mr. Gibson conveyed a fine tone of fellow feeling in offering the testimonial. He spoke of the fidelity and steadfastness of the act of the locomotive engineer, of his great presence of mind and the practical showing of long training. "Yet," said Mr. Gibson, "Engineer Haggerty has done just what hundreds of other men of the road might have done under the same circumstances. The company is not singling him out as the one of a few of the most worthy of its men in offering this testimonial. He singled himself out just as Dewey did at Manila. He had an opportunity, just as Dewey had at Manila, and made the best of it, just as many another of our men have and would do." Mr. Haggerty replied briefly, indorsing Mr. Gibson's remarks, and the little party that had assembled at the office broke up in a glow of good feeling.

The engineer of the story was on the Cumberland accommodation on the evening of September 6. The train had just stopped at Connellsville and he left his cab. A moment later he saw another train rushing into the station from the rear, and it was evidently beyond control of the engineer. Instantly Engineer Haggerty jumped into his cab, threw his throttle wide open, and his train started with a bound. It was 200 yards beyond the station before the wild pursuing train brought up to it, and the engineer's act made the result a slight shaking up. Engineer Haggerty has been in Baltimore & Ohio service for eighteen years, and for fourteen years he has been an engineman. He lives at Glenwood.

Union Pacific Shops at Omaha.

EDITORIAL CORRESPONDENCE.

When the repair shops of the Union Pacific Railway were built, some thirty-five years ago, the road was the Eastern link of a great trans-continental railroad system, and the people were proud of the great achievements performed by the leaders of that great enterprise. Nothing but praise was heard for the men who had taken the lead in binding the whole continent by ties more momentous for human benefit than all the works of enterprising leaders of human effort in the previous history of the world. The laborer was considered worthy of his hire and the nation gave with no unstinting hand rewards to those who had taken the lead and risked their all in building a railroad from the Missouri River to the Pacific coast.

While the grateful, benevolent sentiments lasted the company were rich in financial resources, and they built their principal repair shops at Omaha without sparing of expense. The plan and construction of the buildings were carried out on the most approved methods known to the engineering world of that day. The tools and the equipment were the best that money could buy. The present appearance of these shops is an eloquent testimony to the improvements in shop design and arrangement that have come in three decades. It is doubtful if the original plan could have been improved upon materially had the shop continued to do the repairs on one hundred or less small engines, but they were not made susceptible of natural expansion, and the unforeseen growth of business has forced expansion by isolated pieces, involving much extra expense in doing the work.

The greatest mistake, however, that the original designers and builders fell into was in not providing for the free admission of light. That is the cheapest commodity that a designer can deal with, yet the old-fashioned machine shop was built in a fashion that indicated utter ignorance of the value of light. All over the coun-

try we run upon railroad machine shops that require artificial light at noon. It is safe to say that in such places from 15 to 20 per cent. of output of work is cut off because workmen are groping in the dark.

I have not visited railroad shops for a long time where so much successful work has been done to overcome the shortcomings of the original design and arrangements as in the case of the Union Pacific shops at Omaha. I was unfortunate enough to miss our stupendously energetic friend, Mr. J. H. McConnell, superintendent of motive power and machinery, and his master mechanic, Mr. Barnum, but the general foreman, Mr. John A. Turtle, did the honors in handsome shape, and led me from shop to shop and from tool to tool, till I longed for a stenographer to take down the notes.

In a general way, what struck me most was the ingenious contrivances and methods devised to make the production of an ancient shop equal that of one with perfect arrangement of buildings and tools. They have an excellent plant of first-class tools, although some of them might be sent to the junk shop with advantage to all concerned; but the conspicuous work done by the men in charge has been devising aids to reduce the cost of handling material to its lowest limit.

Practically all the men in charge of railroad shops nowadays are alive to the advantages of using appliances operated by compressed air as lighteners of human labor. This means of lightening human toil has been carried out to a greater extent in the Union Pacific shops at Omaha than in any place I have ever visited. Not only are all the principal tools served by air hoists, but they are so arranged in many cases that the hoists hang from one overhead trolley, which conveys hoist and work to the point where the latter is to be put down or taken up. In other cases the hoist is moved back and forth by the connections of a horizontal cylinder which is particularly convenient in handling work for wheel lathes.

But hoisting weights does not by any means cover the work done by appliances operated by compressed air. One way they use this means of transmitting power struck me as unique. The proper way of lifting engines off their wheels in a big shop is by an overhead crane. To dream of such a thing for the Omaha shops was visionary, and the men in charge proceeded to do the next best thing. They found that the ordinary hydraulic jack was getting too weak for modern locomotives, and they proceeded to figure on the size of a pneumatic jack to do the work. They purchased steel tubing 24 inches diameter, bored it out true, put in a piston with a ram for a rod, made a head which guided the ram, and they had a tremendously powerful jack. With 100 pounds air pressure each of these jacks is capable of raising over 22 tons. One is placed at each side under the back frames, and two of them in front. They raise the engine about 4 feet, and it never declines to move when the air is let in. They connect the two cylinders that are acting in concert with what they call a tandem hose, or what I should call a hose with two branches. If one should get accidentally knocked off, the air from both cylinders would escape evenly and there would be no tipping over of that end of the engine.

After trying all sorts of methods for securing the firebox crown to sustain the immense pressure put upon it, the Union Pacific people have gone back to the old-fashioned crown-bar. They are abandoning radial staybolts because they never could prevent the cracking of the firebox crown in front of the front row of stays. The only objection to the crown-bar is that it increases the weight of the firebox, and the crown is not easily kept clean. In connection with securing the crown-sheet to the bars, I was interested in what Mr. Turtle called the evolution of the crown-bar bolt. First, they used a bolt that was threaded above the head, and thereby was expected to be water-tight. It was not, and the job of preventing leakage once commenced was perplexing. Then they tried a bolt that was turned true where it goes through the sheet. This was all right, but expensive. Now they use a bolt as it comes from the Acme header, finished at one operation, and it is perfectly satisfactory.

Details of work for making the firebox strong, safe and tight seem to receive a little more attention in the Omaha shops than in any place I am acquainted with. Particular attention is bestowed upon staybolts. When the bolts are cut off the proper length, they are put into a special machine made in the shop and drilled about 2 inches deep. The machine that does this work has two spindles that work together. I noted the time taken to drill the two bolts, and it ran about thirty seconds. Then the bolts are put in a lathe and about ⅛ inch is cut off the middle, with a view of making it flexible there. Then it is threaded in a lead screw lathe. After that it is ready for applying. But they do not follow the old practice of screwing in the staybolt from the outside. That practice involved the nipping off of part of the bolt outside that had been drilled, and it closed up the safety hole. They screw in the bolts from inside the firebox, and when they are all in, turn the boiler upside down, lower a pneumatic nipper and take the superfluous ends off the bolts. This is reversing the usual process, but it works well.

I have on my memorandum book a great many notes about shop operations, but it will be more convenient to convert them into independent items, a kind of writing that mechanical papers use up with great avidity. S.

The Coal Consumption of the Oceanic.

The White Star line steamer "Oceanic" has been the all-absorbing marine engineering topic of the month, and comparative tonnage and horse-power figures and speeds have been glibly used even by the average man met in the streets. To the multitude, however, they have more than likely failed to make a correct impression of their meaning, and a realization of what the 28,000 horse-power of the big ship actually represents has come to only a few. Taking into account the steam used by the host of auxiliary engines and pumps on board such a vessel, and that used for heating purposes, it is probably not far out of the way to make a total allowance of 18 pounds of steam per hour for each horse-power of the main engines. This would mean that 252 tons of steam per hour would be necessary to keep things going, and that, therefore, the same number of tons of water would have to be evaporated in the boilers during the same time. For a 24-hour run the amount of steam consumed would be a little over 6,000 tons, and on the liberal basis of a boiler performance of 10 pounds of water evaporated for every pound of coal burned, this would mean a daily coal consumption of at least 600 tons. It is expected of the "Oceanic" that she will preserve a clock-like regularity in her trips, be the weather calm or boisterous, and as one Wednesday will witness her departure from one side of the Atlantic, so the following Wednesday morning should see her arrival on the opposite side. To accomplish this in fair weather would require less power than the ship has; the balance is to be a reserve, available should occasion require. For this reason the daily coal consumption will probably range below the estimated figure given above. To show how the "Oceanic" transcends that leviathan of earlier years, the "Great Eastern," it is interesting to recall that the length of the latter was 680 feet; that the "Oceanic" is 704 feet. The former's light draft was 15 feet; the latter's is 22 feet. Their respective light displacements are about 12,000 tons and 18,000 tons, and weights of hull, 8,000 tons and 12,500 tons, and when voyaging it is estimated that the "Oceanic" weighs about 28,000 tons, against the "Great Eastern's" 25,000 tons. It has become customary in later years to look upon the "Great Eastern" as a monument of extravagance as regards size, and as physically and financially beyond proper control; and yet in the "Oceanic" the world has a vessel whose figures altogether overshadow those others and whose success is practically assured. But the first was an adventure on theory, while the second represents enterprise boldly advancing on experience.—From *Cassier's Magazine* for October.

If you want an index, don't hesitate to drop us a line.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(107) R. W. C., Scranton, asks:

What constitutes a consolidation locomotive? A.—A locomotive having four pairs of driving wheels connected and a pony truck in front.

(108) H. A. C. asks for composition of rings used in metallic packing. A.—This varies but is generally something approaching babbitt. The new Multi-Angle packing of the United States Company enables a softer metal to be used without squeezing out. The softer it can be used the better.

(109) G. N., Sanford, Fla., asks:

What is the common method of locating the center of the link saddle pin? A.—It is generally done on the drawing when designing the motion. In some shops the lifting hanger is temporarily secured to the saddle and the best point for the pin located by trial. The best point is that which gives the most even distribution of steam.

(110) G. A. T. writes:

Please let me know how blue-prints are made. A.—Drawing paper is made sensitive to the light by a solution, which varies according to the ideas of the individual. A tracing is placed over it and held in contact with it—usually by glass. Wherever the light shines through turns the paper blue, but the black lines on the tracing do not allow light to pass. After a sufficient exposure it is placed in clear water. The lines wash out white, and the body of the paper remains blue.

(111) J. W. C. asks:

1. In counterbalancing an upright engine, single cylinder, must not the entire weight of reciprocating parts and connecting rod be balanced? A.—1. In a vertical engine we should advise counterbalancing full weight of piston and rod, cross-head and connecting rod. No formula is required; simply weigh the parts and place this weight at the distance from center of shaft as the crank pin. 2. Where can I procure information about the construction and operation of electric signals? A.—2. "Block and Interlocking Signals," by Elliott, is the best book on signals ever published. $3 at this office.

It is curious how persistently practices come up periodically in mechanical operations which have been repeatedly proved to be bad. One of these is the saving effected by not boring out car bearings. Those who follow this practice for a time say that by tinning or babbitting the face of the brass as good results are attained as if the work of boring had been gone through. It has, however, always proved a fruitful source of hot boxes.

In Cuba.

BY W. D. HOLLAND.

There are, no doubt, a great number among the American railroad men who are thinking of going to Cuba in order to better their fortune, domestically and financially, and though my advice to any of these fortune seekers would be, to quietly stay at home, as their services are not needed on the island, I am sure many of my countrymen will insist upon seeing with their own eyes, and to those I now offer myself as a guide.

There are steamers leaving for Havana from New York twice a week, from New Orleans every Thursday, and from Mobile once in ten days; so we can take our choice among the different routes; the fare on either line being about the same—$32 to $37. Let us decide to go by the way of New Orleans on our imaginary trip, and to take a Southern Pacific steamer, which affords us far better conveniences than any of the other lines. While the New York vessels are no lime-juicers, they employ for their help a number of bowery flunkeys whom you are obliged to tip continually if you want to be waited on at all; thus I would advise all travelers to embark from New Orleans direct. A four days trip will safely carry them to Havana. It would be a very wise thing, on leaving the Algiers wharf, to be supplied with at least $100 to guarantee a safe return to some part of God's country, where you can relate your experience and find sympathy for your trials in "Cuba libre."

At 11 A. M. we climb the gang-plank and are shown our berths by the purser, and half an hour later we are on the way down the Mississippi River towards the Gulf of Mexico. Our first stop is at Key West, a hot, sandy, miserable island, and after a few hours we are off again for Havana, where our vessel is due at 7 P. M. on the fourth day. The following morning the coast of Cuba rises before our eyes, and from the promenade deck we gaze at the famous Morro Castle in the distance and at a number of block-houses along the shore. As we draw near, Old Glory salutes us, and we feel at home at once. From out the waters rise the remains of the ill-fated "Maine." She is sinking fast, and does not resemble her pictures any more. The captain and chief engineer of our vessel wish us good speed, and we go ashore to find the home impressions excited by the familiar colors soon fade away, when we hear nothing but Spanish spoken around us. To me it is no more than I expected, and being well versed in both languages, I am in no way inconvenienced.

My first stop in Havana was at the Inglaterra Hotel, where I took lunch, and then had a walk around the city, where, to my surprise, I did not meet a single American civilian. I visited the railroad shops, and found only two Americans working there, the greater part of the employés being Cubans. Havana is a large city, almost the size of Cincinnati or San Francisco; so it is hard to find anybody without knowing his number and address; but when I finally found the American colony I was agreeably surprised to meet a great number of friends and old-time acquaintances. There were Tom Madden, of Chicago; W. Raynor, from Mexico; Augustine Shaw, from Lima, Peru; Harrington, from Lathrop, Cal., and last, but not least, my old friend Brigg, formerly trainmaster in Guatemala, and at present appointed as sanitary inspector of Havana, being known far and wide for his admirable scent. I was once more at home with the old-time boomers. They were mostly in the Quartermaster's Department of the United States army, and all offered to assist me in getting a position.

For the next couple of days I inspected the shops and railroads out of Havana, and I must say that Cuba is by no means the ideal for a railroad man. There are a few contract shops at Regla, where only Cuban mechanics are employed, except the foreman of the machine and boiler shops, where the main work is done for vessels in need of repair. The wages for machinists and boilermakers average from $2 to $4 Spanish gold daily, with a discount of 11 per cent. in American coin. My next visit was to the D'Este shops, a very neat, tidy place with an Englishman for a master mechanic, while the general foreman and the other bosses were Cubans. This road runs to Pinar del Rio, and has about thirty-five locomotives, mostly Baldwin and Rogers make. I had a long talk with the master mechanic, who seemed to be quite an agreeable fellow, and he told me that there were no foreigners employed, but that the native mechanics were very skilled, likewise the engineers and trainmen. I was introduced to his Cuban foreman, and found him quite intelligent and sociable, more so than the American pinheads in Mexico. From him I learned that the wages of a mechanic ranged from $2 to $4 Spanish gold, engineers making about 135 of the same dollars per month.

The next shops I visited were those of the Marino road, the smallest local line that runs from Concha station, Havana, to Marino, where our American soldiers are quartered. The pay on this road is exceedingly poor. Mechanics make about $2.50 a day, and engineers $90 per month, running from 6 A. M. to 12 P. M., eighteen hours per day. The United Railways of Havana, with their main shops at Cerro, four miles from the city, form the largest and best line on the island, having about 225 miles of road with about seventy-five locomotives. It is an English company, and the superintendent of motive power is Mr. R. S. Black, a very amiable gentleman and a most skilled mechanic. He was lately sent over from England, and

found a hard job awaiting him, the Spaniards having left the shops in a most terrible condition. When the road was bought from them by its present owners, the master mechanic found rickety old tools to work with, a score of dilapidated engines with burnt fireboxes and worn-out machinery, destroyed box cars and rolling stock in an altogether miserable shape. Mr. Black, however, was up to the task, and was getting things fixed up nicely, repairing cars and engines, and giving the whole shops a thorough overhauling, and his Cuban employés did good work. I must say, the native roundhouse foreman, master car builder and shop foreman were nice fellows, and better mechanics than the Mexicans and South Americans. The wages are from $2 to $4 Spanish gold to mechanics, and to engineers $135 per month. I had a couple of copies of LOCOMOTIVE ENGINEERING, and those able to read English translated it for the Cubans, and I believe if this journal had a Spanish edition, every man on this road would subscribe for it.

Very strange to us Americans seem the working and the meal hours of the Cubans. At 5 A. M. is the first meal, and at 6.30 work commences; again, at 9.30 they have what they call breakfast, and start in again to work steady from 10.15 until 5 P. M. without anything to eat between times, which I hardly think would suit many Americans.

The next large shop of this system is at Matanzas, where Mr. Tynar is master mechanic, and all his men are Cubans. Here I saw twenty-five locomotives, and the shops are quite small, all repairs being done in the roundhouse. I should judge they employ about fifty men, at the same wages paid at the other roads.

From the above sketch it will be seen that Havana is no inviting place for American mechanics or trainmen, and visitors to Cuba would soon convince themselves of this fact, as I have done, and be glad to have some of the aforesaid $100 left to embark again for God's country, and to thank heaven to get aboard the steamer and escape the continual conversation of yellow fever and malaria, not to speak of the good fortune of not being themselves victims of this plague of the tropics. Thus, with relief and thankfulness we see again rise before our eyes the beloved shores of the "land of the free and the home of the brave."

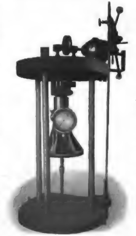
Keeping Steel Castings From Heating.

The use of cast steel for a great many parts of locomotives that were formerly made of cast iron is becoming daily more common, and the stronger metal promises soon to push the weaker out of use for all purposes where the article is subjected to heavy strains. While this change is going on it is curious to observe the practices followed in different places where special treatment is considered necessary to prevent the steel from causing heating by excess of friction. On some roads soft metal is considered essential as a lining to the steel; other roads run steel to cast iron without cutting. A hard member to keep out of trouble is the driving-wheel box. On the Missouri Pacific they carefully babbitt the sides of the box and the bearings for wedge and shoe. The Union Pacific people polish up these surfaces with a roller, and seem to get as good results.

Using Hydraulic Press for Light Work.

The Chicago & Western Indiana Belt Line Railway use an ordinary 20-ton hydraulic jack to press in driving-box brasses. It is so set up that it can easily be taken down and used for other work. Bottom and top castings made of old boiler-shop formers are connected with 1½-inch bolts. These castings are held 4 feet apart by pieces of flues on the bolts as ferrules.

The head of the jack is held to the top casting with two small tap bolts. An eccentric and strap connection works the pump in the head of the jack. This eccentric is run by an air motor which can be put on when needed and taken down to be used for other work in an instant.



HYDRAULIC JACK FOR LIGHT WORK.

The pipe shown coming up through the bottom casting is the piston rod from a 3-inch air cylinder below, which lifts the jack body and holds it up when placing the boxes. A gage is connected to the jack. This is taken off and the hole plugged when not in use. The illustration shows all the features plainly. It is surprising how fast and accurately this does the work. General Foreman A. J. Cunningham is the designer of this device.

Reporter's Description of Molding.

When the ordinary reporter attempts to describe anything connected with railroad machinery he generally makes a mess of it. He does the same thing when he ventures to describe operations in any workshop. Here is one of the most refreshing performances we have seen lately. It is clipped from *The Foundry*, which found it in a New England paper:

"A goodly amount of business prosperity has attended the Merriam & Tilden Foundry, on Hope street, since its inception, a few years ago. At first seven men were employed. The number has been increased until at present twenty men are kept busy. Last week the largest casting ever poured hereabouts was made. It was a 16-foot lathe-bed, and required nearly a ton and a quarter of molten metal in its manufacture.

"To watch the making of a casting is an interesting sight. They are made in molds or 'flasks.' These flasks, as they are called, are boxes of sand in which an impression of the gate or pattern is taken. After the required number of flasks are ready, the 'wind' is let on. Letting on the wind is starting up a bellows-like arrangement which forces the hot air up through the cupola, which has previously been filled with bars of pig iron, under which a large bed of coal is fiercely burning.

"When the metal is hot enough it runs out a spout in the front of the cupola and is caught in a caldron. The molders' ladles are filled from this caldron. This 'drawing the iron,' as it is called, is a very pretty sight. Sparks fly in every direction and look very much like a large flower pot in a pyrotechnic display. This effect is more or less intense according to the hardness of the iron.

"A flask which has been poured into must be finished without a stop. If the molder stops an instant in pouring in the molten metal and then resumes, a seam will form at the place of stopping, and a worthless casting will be the result.

"In pouring large castings like the one mentioned above, a crane and chain blocks are employed, and a continuous stream of metal is kept flowing until the flask is full.

"That a casting of the dimensions of the one herein described should come out perfect and straight as an arrow reflects much credit upon Manager W. A. Kenney and his workmen."

There is a good deal of talk among capitalists about a stupendous half round the world transportation scheme, said to be supported by James J. Hill, of the Great Northern. It embraces fast steamers from England to New York, fast trains from the Atlantic to the Pacific coast over lines controlled by Mr. Hill, fast steamers from Puget Sound to Hong Kong. The calculation is that the trip could be made in thirty-one days.

A Pittsburgh Standard Passenger Locomotive.

While there is, perhaps, nothing unusual about this engine, it is a good example of the standard eight-wheel or American type of engine. It has recently been delivered to the Kansas City, Fort Scott & Memphis Railway by the Pittsburgh Locomotive Works, where it was built under direction of Mr. W. A. Nettleton, superintendent of motive power.

The general dimensions follow:

Total weight of engine in working order—125,000 pounds.

Total weight of engine on drivers—84,000 pounds.

Driving wheel base of engine, 8 feet 6 inches.

Total heating surface—1,782.2 square feet.

Brick arch supported on tubes.

Diameter of driving wheels, outside of tires—69 inches.

Diameter and length of journals—8 x 11 inches.

Diameter of truck wheels—30 inches.

Diameter and length of journals—6 x 10 inches.

Slide valves—American balance.

Water capacity of tank—4,300 U. S. gallons.

Fuel capacity of tank—8 tons.

Weight of tender with fuel and water—91,000 pounds.

Type of brakes—Westinghouse American.

Westinghouse train signal.

PITTSBURGH EIGHT-WHEELER FOR KANSAS CITY, FORT SCOTT & MEMPHIS.

Total wheel base of engine—23 feet 3 inches.

Cylinders, diameter and stroke—18 x 26 inches.

Diameter of boiler at smallest ring—60 inches.

Diameter of boiler at back head—70⅛ inches.

Crown sheet supported by radial stays—1⅛ inch diameter.

Number of tubes—254.

Diameter of tubes—2 inches.

Length of tubes over tube sheet—12 feet 2 inches.

Length of firebox, inside—96 inches.

Width of firebox, inside—40¼ inches.

Working pressure—180 pounds.

Grate area—26.8 square feet.

Heating surface in tubes—1,614 square feet.

Heating surface in firebox—149 square feet.

Heating surface in brick arch tubes—19.2 square feet.

Shop Additions on the Chicago and North Western Railway.

The Chicago & North Western Railway have some new buildings under way at the main shops in Chicago which are at a standstill on account of the delay in receiving structural steel for the posts and floor beams.

The new power house, 102 x 112 feet, is well along. One section of it will have three Babcock & Wilcox boilers of 500 horse-power each. The engine for driving the machinery, the compressors and dynamos will go in the other section. The chimney is under construction. It will be 180 feet high, which will give a good draft for the boilers.

A new machine shop is going up adjoining the present one, in which will be installed small machines, like turret lathes, etc., to manufacture all the small supplies in the line of repairs for injectors, lubricators, small brass work, air-brake repairs, etc., that are used by the company. This machine-shop addition is 100 x 150 feet. It will be two stories high, with most of the machines up on the second floor, which extends around three sides of the building, with an open space in the center.

The new boiler shop, 120 x 302 feet, with fourteen stalls, each sufficiently long to hold two or more boilers under construction or repair, has the walls up.

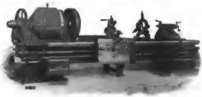
A new turntable for one of the roundhouses has just been put in, which is to be turned by an electric motor. The traveling cranes and transfer table are electrically operated now. Mr. Quayle expects to use more of this power in the future.

The present ashpit has a depressed track next it in which the cinder cars are placed and ashes loaded by hand. Mr. Quayle intends using large buckets, fitting in the pit. When they are full they will be raised up and dumped in the cars, doing away with hand power. This method will be more expeditious and economical.

Under existing laws a railroad man who owes debts in West Virginia may be attached in Maryland, and will lose his wages if the debt can be proved. The annoyance of these attachments has caused the Baltimore & Ohio Railway Company to notify all its men that those who have their wages attached will be discharged. The result has been many changes, and the men who are in debt have been in hot water. Recently, on the advice of attorneys, fourteen B. & O. employés, including engineers, firemen, brakemen and shop hands, filed in the United States Court petitions in voluntary bankruptcy. Their assets ranged from $5 to $65, and the liabilities from $95 to nearly $500.

Motor Driven Lathe.

The illustration shows a 28-inch swing screw cutting engine lathe driven by "Bullock" type "N" motor. The motor is placed directly on the spindle in the head stock, taking the place of the cone pulleys. The armature spider is built directly upon



MOTOR-DRIVEN LATHE.

the hollow spindle of the lathe. By means of a new system of variable speed control the motor is given a greater range of speed, without loss of torque, than is ordinarily given by the cone pulley, having sixteen speeds in either direction, including the back gear. The controller is placed upon the leg of the lathe, directly under the head stock, and is operated by a splined shaft running along the bed of the lathe and a handle which travels with the carriage. The slowest speed is 60 and the highest about 250 revolutions.

The motor is fully described in bulletin No. 4535, which may be had by addressing the Bullock Manufacturing Company, Cincinnati, Ohio.

Portable Motors and Tools.

Railroad shops, fully as much as others, perhaps, have use for portable motors and tools. This is particularly true of work on the front end of a locomotive.

Most locomotive works have several of these in the erecting shop, mounted on wheels and capable of being raised and lowered, so as to get at the work. Power varies, but is usually either air, steam or electricty, with the first and last in most favor.

The West Albany shops have a neat device, consisting of a truck with four uprights. These guide the vertical movement of the little engine which is on a movable platform, controlled by two screws, one at each end of the truck. These raise or lower, and also hold the motor at any desired height that is convenient, and power is transmitted by universal joints and telescoping shafts. These seem to be growing in favor, and have replaced the flexible shafting in several places recently visited. This motor was driven by air.

Schenectady Locomotive Works use electric power, and the motor is located at the base of truck, but power is transmitted vertically and then taken off at the desired height.

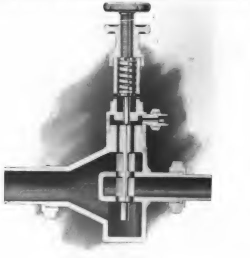
There is another method which is growing in favor for this work. It is carrying an air pipe wherever you want to work, and using a pneumatic drill or other tool as the case may be. There are few cases where this cannot be done, and it seems to be the modern way.

The Eclipse Reducing Valve.

Among the claims for this valve are that there is no diaphragm to break, no stuffing box to leak and only four parts to the whole thing. As simplicity is one of the features which appeals to any mechanic, it seems safe to say that they will be interested in Eclipse reducing valve, shown with this.

The working parts are so plainly seen that little description is necessary, and as they have proved satisfactory on several leading roads after severe tests, little remains to be said.

They are made of best steam metal, and it is claimed that no variation of boiler pressure will affect pressure at outlet. Now that car heating is a live subject, it is a good time to write to the makers for further details. They are the John Davis Company, 51 to 79 Michigan street, Chicago, Ill.



ECLIPSE REDUCING VALVE.

Railroads not Responsible for Fires Caused by Sparks.

The Supreme Court last month decided that a provision in a lease by a railroad company, authorizing the construction of a warehouse on its right of way, relieving the railroad company from all liability for damage for the burning of the warehouse by sparks from the company's engines, or from the carelessness or negligence of its employés, was valid. A warehouse was built on the right of way of the Chicago, Milwaukee & St. Paul Railroad Company in Monticello, Iowa, under a lease containing such a clause, and seven insurance companies paid the loss of $23,450 on this building. The fire was caused by sparks from a railroad engine, and the insurance companies sued the railroad company to recover the money that they had paid, claiming that the exemption clause in the lease was void as being against public policy. Justice Gray, in his decision, said the validity of the agreement does not depend upon any principle of the commercial or mercantile law. It was local law. The judgment below, in favor of the railroad company, was affirmed.

It has been repeatedly decided by the courts that a railroad company, which uses the best known spark arresting appliances upon its locomotives, is not liable for fires caused by spark throwing.

Heavy Compound for Northern Pacific.

This is one of fourteen recently built for the Northern Pacific Railroad by the Schenectady Locomotive Works. They are of the same general type as those built some time ago, with the exception of having a piston valve on the high-pressure side. They are said to handle much easier than the slide-valve engines.

Driver brakes are applied to back of wheel instead of forward. Front end of firebox is depressed to increase depth under tubes. The heating surface is very large, as will be seen. These engines are in very severe service and are giving entire satisfaction, both in fuel economy and repairs. The leading dimensions are:

Weight in working order—175,500 pounds.

Diameter and length of side rod crank-pin journals—F. and B., 5½ inches diameter by 4½ inches.

Outside diameter of first ring of boiler —70 inches.

Working pressure—200 pounds.

Firebox, length—120 3-16 inches.

Firebox, width—41 inches.

Tubes, material—Charcoal iron No. 12.

Tubes, number of—376.

Tubes, diameter—2 inches.

Tubes, length over tube sheets—14 feet 2 inches.

Fire-brick supported on water tubes, No. 8 Allison, 3-inch.

Heating surface, tubes—2,772.6 square feet.

Heating surface, water tubes—32.1 square feet.

SCHENECTADY TEN-WHEELER FOR NORTHERN PACIFIC.

Weight on drivers—134,200 pounds.

Wheel-base, driving—14 feet 10 inches.

Wheel-base, rigid—14 feet 10 inches.

Wheel-base, total—26 feet 8 inches.

Diameter of cylinders—22 and 34 inches.

Stroke of piston—30 inches.

Piston-rod and valve-stem packing—Jerome.

Size of steam ports—23 x 2⅛ inches.

Size of exhaust ports—23 x 3 inches.

Size of bridges—1⅜ inches.

High-pressure piston valve; low-pressure, Allen-American.

Greatest travel of valves—6½ inches.

Outside lap of valves—High-pressure, 1¾ inches.

Inside lap of valves—Clearance, ¼ inch.

Diameter of driving wheels—63 inches.

Diameter and length of driving journals—9 inches diameter by 11 inches.

Diameter and length of main crank-pin journals (main side, 7 x 5¼ inches)—6½ inches diameter by 6 inches.

Heating surface, firebox—208 square feet.

Heating surface, total—3,012.7 square feet.

Grate surface—34.22 square feet.

Boiler supplied by Hancock inspirator, type "A," size No. 10, R. S.; Ohio lever handled, standard "A," size No. 10, L. S.

Water capacity of tender—4,350 United States gallons.

Coal capacity—9 (2,000-pound) tons.

Total wheel-base of engine and tender—53 feet 6½ inches.

American brake on all drivers operated by air. Westinghouse automatic air brake on tender and for train; 9½-inch air pump. Two 3-inch Ashton safety valves. Leach sand-feeding apparatus.

Where Canal Boats Ride on Cars.

No railroad in the United States offers as fine an opportunity for study of the old canal systems of the East as the Lackawanna Railroad. For miles its track follows the old Morris & Essex Canal, built before the railroad was dreamed of, for the purpose of bringing coal from the mountains to the great city of New York. A canal in a mountainous region is a thing of wonder, and the traveler has numerous opportunities of viewing the curious machinery by which the canal boats are drawn up the hills on railroads to strike the canal at a new level, or lowered from the canal from a higher level, to continue further down the mountain. This old canal, though grass-covered and bordered by the most magnificent shrubbery, is still used, and the traveler sees from time to time one of the old boats moving slowly through the limpid waters, with sleepy mules for motive power.

In our General Correspondence department we publish a letter giving a fireman's view of smokeless firing, in which some remarks are made about men who dislike each other being kept upon an engine together. That is a matter which receives too little attention on many roads, and the company's interests suffer in consequence. If the engineer and fireman do not dwell in harmony they ought to be separated, for they will naturally be more interested in embarrassing each other than in doing their work conscientiously and properly. There are men so constituted that they can never agree long with anybody. The cab of a locomotive is a bad place for men of that disposition. We have known first-class men, both among engineers and firemen, whose only fault was infirmity of temper. That, however, is a very grave fault, and men possessing it ought to be sent to other kind of employment than having a place in the cab of a locomotive.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Air Brake Testing Plants.

The time has come when a railroad that is up to date in air-brake matters must have its air-brake testing plants at such points upon the road that the piston travel can be kept within the prescribed limits determined by practice. Competent inspectors or repair men, instructed by an air-brake inspector or instructor, should be in charge of these plants and systematic testing of brakes should be made to detect leaks, adjust piston travel, remedy or replace faulty triples, and find and repair any existing defects.

Air-brake cars have now become sufficient in numbers so that a large majority of freight trains may be controlled with air brakes. It frequently happens that there are enough brakes, in number, to control a train, but the condition of the brakes forbids the attempt, and it is unjust to an engineer to expect him to hold trains on grades if the brakes do not receive systematic inspection. The idea of holding trains by air when there is a doubt as to the condition of the brakes, and then blowing for hand brakes, after it is found that on the grade the air does not hold, is wrong. If the brakes are in condition, the engineer knows whether or not he has sufficient brakes to do the work on the hill, and that feeling of nervousness and uncertainty, felt on roads having no systematic tests, is unknown.

It is to be regretted that so many private-line car companies do not pay more attention to air brakes.

Not only is it necessary to adjust the piston travel on the air-brake cars for the sake of the air brake alone, but the effect of allowing the travel to become too long also has its effect on the hand brake, especially on the heavy-capacity cars now in existence. For instance: With many of our heavy-capacity cars an extra lever—called the hand-brake lever—is put in between the hand-brake end of the piston lever and the brake mast, in order to give the proper hand-brake power. This is done more particularly on coal or ore cars with the cylinders fastened to the side sill. The accompanying sketches illustrate three such devices now in use.

With either of these devices, and the proportion of levers cited, if the piston travels 10 inches, the point at the end of the hand-brake lever, or a point on the chain as used with the sheave, travels a little more than twice this amount, and about 20 inches of chain must be wound upon the brake mast to set the hand brake. This means that the brake-mast drum will be wound full of chain before the shoes are up to the wheels and the hand brake on this car will be useless. In switching such cars, trouble will result for the brakeman, and there are big chances of damage being done to the car if the brake slack is not regulated systematically.

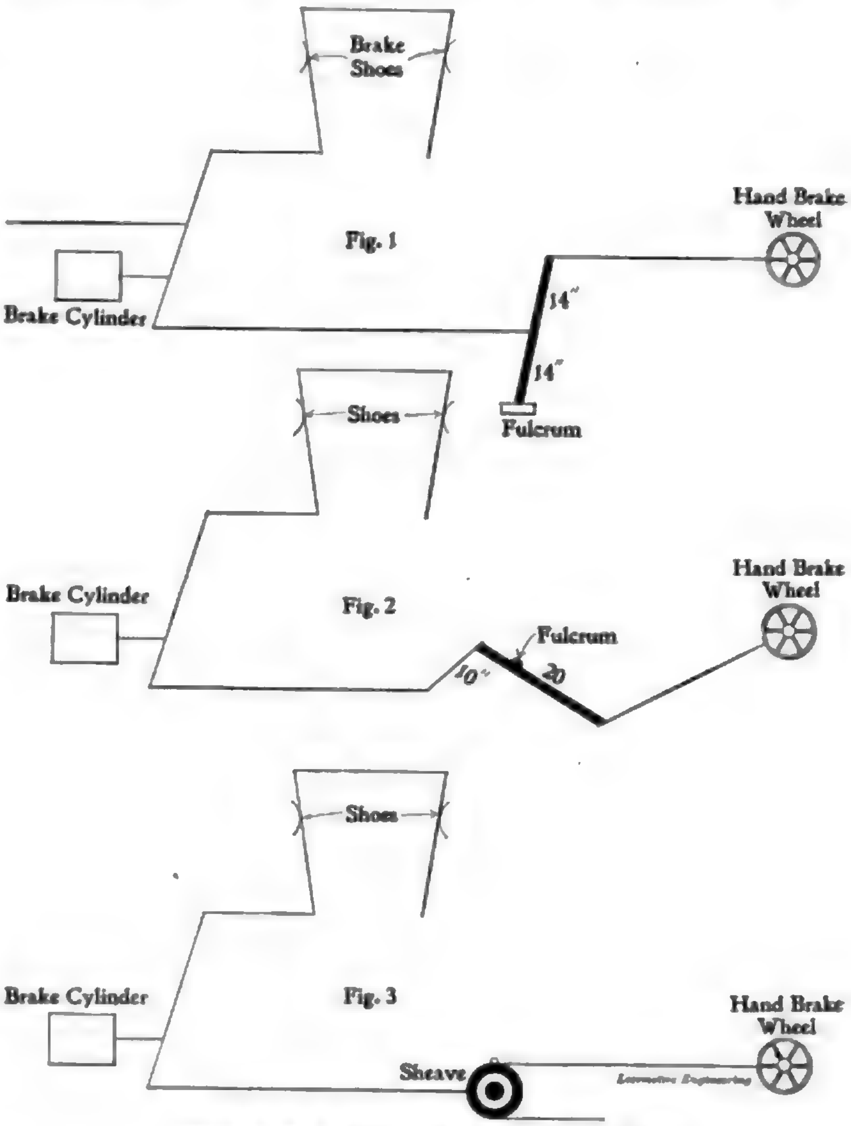
On many coal and ore cars the travel of the levers, due to the hoppers, is somewhat restricted; and if long travel does not result in poor hand brakes, because of more chain existing than will wind on the brake-mast drum, it may be that a lever will strike a carrier iron and the braking power will not be transmitted to the brake shoes.

The question arises: Will railroads put in testing plants before wrecks in yards and on roads prove their expediency, will it be another case of live and learn, or will an ounce of prevention save a pound of cure?

It is the duty of every railroad air-brake inspector or instructor to put this question before the proper officials of his road and get them to see the absolute necessity for the systematic testing of freight as well as passenger brakes. B.

New York.

Liquid air is not yet performing the wonderful work claimed for it by its promoters, and the probabilities are that it will not do so soon, if ever. The problem of storing this highly explosive liquid is a troublesome and controlling one; and until this is solved liquid air will defer its application to ocean steamships, railway and street cars and refrigeration processes, and will humbly remain a laboratory product and plaything.



THREE WAYS OF CONNECTING AIR AND HAND BRAKES.

Points to be Watched in Defective Air Brakes.

The regular and systematic inspection and repair system for air brakes which the Nashville, Chattanooga & St. Louis Railway quite some time ago instituted at its Nashville and Atlanta terminals has not only been productive of bettering the service, but, at the same time, has served to point out the seemingly weaker places in the system which should be watched by repair men.

Following is a list of cut out cars coming into the Nashville yard during the month of September and the cause for which the cars were cut out:

Emergency valve seat leaking	45
Triple valves needed cleaning	41
Triple valve gaskets leaking	47
Check valve case gaskets blown out	16
Union on Triples leaking	45
Nothing wrong	4
Blowing at exhaust	35
Blowing at vent ports	18
Graduating pin gone	1
Thread on check valve case stripped	6
Drain cup bolts and nuts gone	4
Working parts of triples gone	9
Release valves leaking	19
Release valve held open by rod	4
Release spring broken	1
Piston travel too short	1
Brake cylinder packing leather worn out	12
Cut-out cock gone	1
Angle cock gone	1
Sand hole in auxiliary reservoir	1
Train pipe broken	5
Branch pipe gone	8
Branch pipe leaking	2
Brake rigging out of order	15
Quick action, service application	11
Total	352

Hand Brakes in Conjunction With Air Brakes.

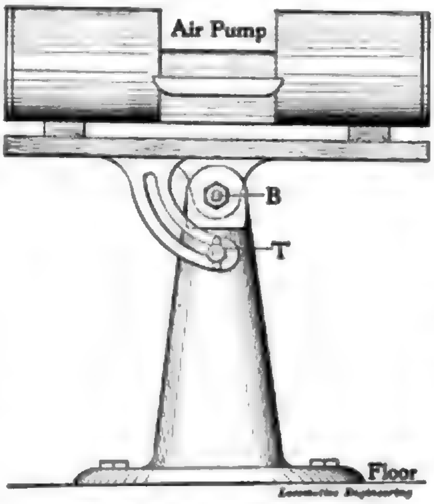
Considerable has been said and written about the use of hand brakes on the rear end of freight trains partially equipped with air brakes on the head end, operated by the engineer. Many, if not nearly all, roads have cause to remember that stage in air-brake practice through which they have passed, and in which troublesome break-in-twos have been eliminated by the abandonment of the hand brakes on the rear end practice while the engineer is operating the air brakes.

The full relief which has almost invariably followed the abandonment of the practice would seem to condemn it; yet there periodically appears some new champion of the old practice, who resurrects it, and seeks by carefully prepared and apparently reasonable statement to establish the meritorious advantage of the scheme, in spite of the fact that scores of roads have advantageously discarded it long ago.

If the efforts and energy expended in making the discarded scheme work were applied to the other method it would, without doubt, make it such an unqualified success as to leave no argument as to which is the better way. Happily, the rapid equipment of freight cars with air brakes will soon give the engineer full control of the train, and before many years the controversy on the merits of the two methods will have passed out and been forgotten. Then, and not till then, will the argument be settled to the satisfaction of both sides.

An Air Pump Repair Stand.

The air-pump repair men at the West Albany shops of the New York Central have a handy stand for inspecting, overhauling and testing pumps. The engraving makes it plain, and while the idea is not absolutely new, these are nicely ar-



REPAIR STAND FOR AIR PUMPS.

ranged for convenience and rapid work. There are four of the stands in this department, and of course they hold any size pump and in any position.

After repair they are set in their proper position and tested, a hose being handy to each stand. Air hose is also tested in this department, as well as the brake valves and triples. They expect to put in a good size air compressor in the near future, both for this work and their numerous air hoists and pneumatic tools.

There is a strong possibility that the yellow fever now prevalent in some parts of the South may necessitate a change in the meeting place of the Air Brake Association. Jacksonville, Fla., was the choice of the last convention, and although the fever may not reach Jacksonville, Florida may be quarantined against on account of the fever in other parts of the State.

Bitter complaint is made by some air-brake men that piping on engines and tenders coming from certain locomotive works have to be overhauled before being fit for service. On one engine recently built by a prominent manufacturer, fourteen elbows and six unions were unnecessarily placed in the air-brake piping on the tender alone.

An Object Lesson in Engine Truck Brakes.

The time has not been so long ago but that all air-brake men can remember the prejudice which once existed against the driving wheel brake. Many men in the mechanical department of railways objected to the driver brake on the ground that its use was injurious to the engine structure. So deep-rooted and general was this objection that a driver brake on a locomotive was an exception rather than the rule, and was looked upon as a rash venture of an intrepid master mechanic.

Perhaps the credit for first equipping all its locomotives with driving wheel brakes belongs to the Pennsylvania Railroad Company, which, in the face of this prejudice, began and continued to apply driver brakes to each of its engines until all were equipped. Other roads were gradually brought to see the fallacy of the prejudice and to recognize the value of the driver brake as an adjunct to train brakes. To-day a locomotive without a driver brake is as rare as an engine with the ancient water pump, and the driver brake is considered equally important almost as the wheels and pistons themselves.

Allowing for the natural difficulty experienced in getting all new devices introduced, it is quite strange that the modern engine truck wheel should meet with the same opposition as did its mate, the driving wheel brake. This opposition, however, is of a different nature. Instead of being considered injurious to the engine structure, the truck wheel brake is unreasonably charged by some with hindering the proper tracking of the truck; that is, the truck is supposed to be held rigid when the brake is applied, and instead of safely guiding the engine around curves, the leading wheels tend to climb the rail. This, of course, is a groundless supposition; for the brake, being intact and self-contained within the truck itself, can have no effect whatever on the tracking whether the brake be on or off.

Recently a remarkable incident occurred which is deserving of record and served to more effectually settle this point in question than any amount of argument could possibly have done. One of our large roads had an engine which climbed a curve and left the track at a certain point. The truck wheel brake with which the engine was equipped was blamed for the accident and was instantly removed. A few days after, the same engine, minus the truck brake, left the track at the same place, necessitating a further search for the cause. Upon investigation, a defective joint in the track was found to be the cause of the trouble, and when placed in condition the trouble disappeared. The wrongly charged and innocent truck brake was replaced, and is to-day quietly and effectively doing its work, having made many good friends by the incident.

CORRESPONDENCE.

Metallic Packing for Driver Brake Cylinders.

Editor:

In the columns of your November number I was surprised to find that the subject of metallic packing for brake cylinders was again brought to life by one of the good brethren in the northeastern part of the country. I cannot agree with him that it is a hopeless task to keep pressure in the driving brake cylinder when ordinary leather is used.

The problem of having good driver brakes is easily solved; first, by obtaining the best oil-tanned leather; second, by taking reasonable precaution in putting the leather in the brake cylinder; third, by using a grease such as Paragon or Kent's brake cylinder compound, instead of using engine oil, commonly termed black oil, in the driving brake cylinder, or any other cylinders, as it tends to destroy the leather, causing it to become hardened and cracked, when it soon leaks.

Again, proper care should be taken of the leathers after they have been in use for some time. They should not be expected to run and last forever. Driving brake cylinders should be stenciled when the new leathers are applied, and after being in use for about three months, leathers should be removed, cleaned and greased, as well as the brake cylinders.

I do not think all the trouble lies with the packing leather. The pipe connecting the triple valve to the brake cylinder is often leaking when the engineer reports the brake cylinders leaking. The lagging and jackets have all been removed from our brake cylinders, and this has added very much to their efficiency as good driver brakes. We are constantly using the test gage, and find that pipe connections are more at fault than packing leathers. If just ordinary care will be taken of the packing leather (and I would recommend either Paragon or Kent's brake cylinder compound for a lubricant) I am confident there will be no trouble from leaky packing leathers.

I notice that Mr. Weber says "that the workmanship must be perfect," which leaves room to doubt of getting the metallic ring tight. Anyone who has tried to make a metallic ring absolutely tight will be thoroughly convinced that a metallic ring will not do in brake cylinders, I am sure. It has been tried, time after time, to use a metallic packing of some kind in brake cylinders; but after so equipping one engine it has invariably been thought better to use a good packing leather instead and have tight brake cylinders.

The cost per engine, $6. This would certainly be first taken into consideration. Eight-inch brake cylinder leathers cost 45 cents, which is much cheaper and will not require cylinder to be rebored. With the methods I have described our engine brakes are made to stand a leakage test of less than ten pounds in five minutes.

OTTO BEST.

Supt. Air Brakes, N., C. & St. L. Ry.
Nashville, Tenn.

Newly Patented Cut-Out Cock.

Editor:

I send you herewith for illustration drawings and specifications of a cut-out cock to be placed underneath the engineer's brake valve.

Its object is to provide a new and improved cut-out or stop cock more especially designed for use when a plurality of locomotives are coupled to a single train, the arrangement then permitting of establishing connection between the train-line pressure and the train-pipe gage, so that each engineer can see what pressure there is in the train-pipe and what is drawn off by the engineer of the leading engine for braking or other purposes, and in case of failure of the leading engine to charge or control the brakes the engineers of the other locomotive or locomotives can instantly charge and handle the brakes.

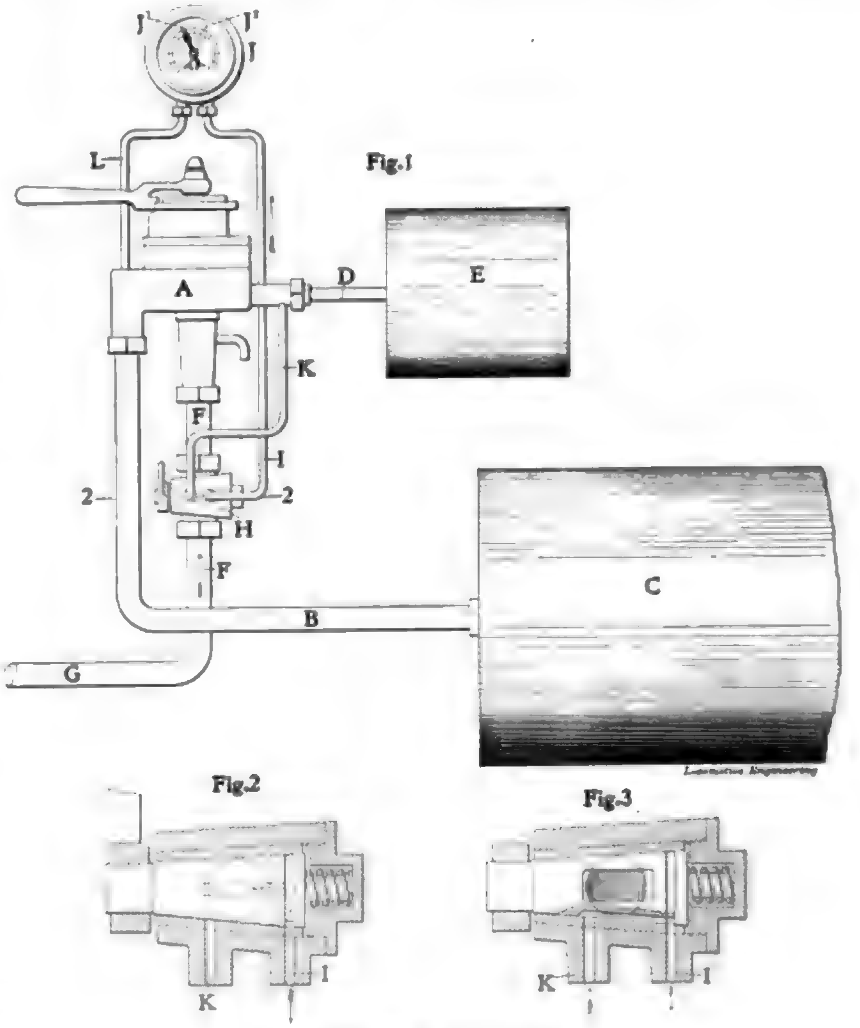
Fig. 1 is a side elevation of the improvement as applied. Fig. 2 is an enlarged sectional plan view of the improvement in a cut-out position, the section being on the line 2 2 in Fig. 1, and Fig. 3 is a like view of the same with the plug in a cut-in position.

The engineer's valve *A* is connected by a pipe *B* with the main air-reservoir *C* and by a pipe *D* with the brake-valve reservoir *E* and by a connection *F* with the train-pipe *G*, said connection *F* containing the cut-out or stop plug *H*, connected by a pipe *I* with the double gage *J* for indicating the train-line pressure by the black hand or pointer *J'* at the time the cut-out plug is in a cut-out position. A pipe *K* connects the pipe *D* with the cut-out plug *H*, so that when the latter is in a cut-in position then the train-line pressure or that of the engineer's valve is likewise indicated by way of the plug *H*, pipe *I* and hand *J'* on the gage *J*. The latter is also connected by a pipe L with engineer's valve *A* to indicate main-reservoir pressure by the red hand *J²*.

This cock was gotten up by our general foreman, and has been approved by our master mechanic and superintendent of motive power.

J. P. BROWN.

C., N. O. & T. P. R. R., Somerset, Ky.



NEWLY PATENTED CUT-OUT COCK.

"Fictitious" Maintenance of Air Brakes

Editor:

In view of the large number of freight cars now equipped, and being equipped with air brakes, the question of their maintenance becomes a very important one. Some of the railroads are paying considerable attention to this point, the majority are paying none at all, and some are paying entirely too much attention of the kind they are giving. The last clause is one calculated to elicit a question, and it is the purpose of this article to answer it and to show that many roads are giving not only themselves but other roads a great deal of trouble by improperly caring for the air-brake equipment.

The writer had the pleasure not long since of visiting the air-brake test and repair yard of a prominent railroad where air brakes are intelligently cared for. To be explicit, it was the Nashville yard of the North Carolina & St. Louis Railway, and what he saw and learned there would open the eyes of railroad officials if they could but see how their money is being thrown away by the ignorance of the men caring for the brakes. In the first place this road is taking proper and economical care of their brakes, and is living up to the Master Car Builders' rule, that foreign cars on their line shall receive the same care as their own. No repairs are made that are unnecessary, and what repairs are made are intelligently and well done.

The question of lubricating brake cylinders is an important one, but the writer does not propose to go into it further than to call attention to the prevalent practice of attempting to fill the brake cylinder with car oil. Some repair men must be under the impression that the brake cylinder is an oil cylinder and should be filled with oil, judging from the condition of many I saw. I have before me the report of defective cars passing Nashville yard in September, and ninety-five of these were caused by defective rubber gaskets, almost all of which were due to the presence of too much oil in the brake cylinder, which blew back through the triple valve and caused deterioration of the rubber. This represented bills of over $16 alone, and all caused by the lack of care or knowledge in lubricating the cylinder. This is only one item, and there are many similar ones that are eating up the income of the railroad companies. It will well repay any general manager or superintendent of motive power to investigate what is being done in this line on his and other roads. The railroad officials have an idea that the air brake is expensive to maintain. So it is, when done this way; but by proper care it is not.

Another thing that has a tendency to increase the cost of maintenance is the fear of some men that the rubber gaskets will not of themselves make tight joints, so they coat them with white lead ground in oil, and in some cases with varnish. The result in the one case is rapid deterioration of the gasket. In the other the gasket sticks to the metal surface and tears when it is necessary to separate the parts, thus making renewal necessary.

Another point that is worthy of attention is the practice of coating the hose coupling gasket with oil, "to make it slip in easy." Oil and rubber are enemies, and this should be thoroughly impressed on the men doing this work; if it is necessary use a club to do so.

Unfortunately, there are still some men on air-brake work who think the manufacturer does not complete his work before sending out the apparatus, and they have to put the finishing touches on it to "perfect" it. An instance of this came to my attention where the man evidently thought the fellow who cut the leakage groove had neglected his work, for this man improved (?) on it by cutting the groove the full length of the cylinder. It is to be hoped that he has been removed from air-brake work to a place where his extraordinary talents can be used to better advantage—say, chipping the burrs off rough castings.

Another matter to be regretted is the poor opinion some repair men have of the ability of others to discern whether a brake is working right or not. They seem to think that a man cannot tell by the operation of the brake whether a cylinder has been cleaned and oiled, and that if they just stencil it, it will work just as well as if they had really cleaned it. "Fictitious cleaning" of freight brakes is going to cost a whole lot some day. Compound interest on the cost of good cleaning for a lifetime will not begin to pay the bill; and the man caught stencilling cylinders without their being cleaned should be unceremoniously "fired."

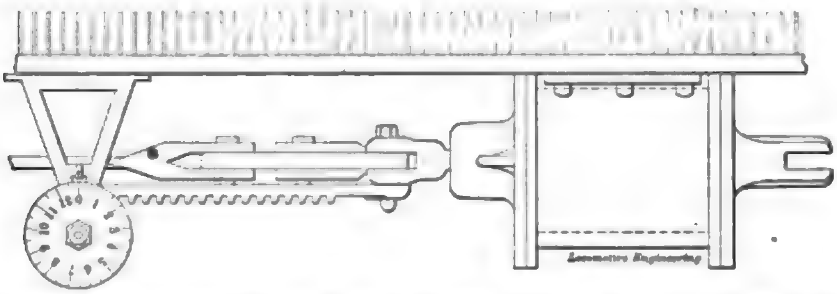
There are just one or two points more. One is the old one of plugging up the retaining valve pipe, a good way to get slid-flat wheels. Another one is one not generally known. When putting the triple-valve gasket in place, put it on the triple valve first, not on the end of the auxiliary reservoir. The reason for this is, the threaded boss on the triple valve will catch it and cause it to kink up at the port opening if it is put on the reservoir first. Another one is, be careful in putting in the cotter pin in the old-style emergency valve when renewing the seat. I saw several where this pin had not been properly put in and the emergency valve and emergency check valve stuck together after a quick-action application. Before putting these valves into a triple valve, try them without the check-valve spring and see that they work freely. One thing more, don't fill the brake-cylinder piston sleeve with nuts, pins, etc., to take up slack. They work around, mash out, and eventually break through the sleeve.

And now let me ask a few pertinent questions of the general officer who may have waded through this article: Who is caring for your brakes—your own men, or do you depend on other roads to do it for you? Are your men doing any of the things outlined above? Are you paying for gallons of oil to be wasted through the triple-valve exhaust and eat out the gaskets? Have you ever given the question of the maintenance of your air brakes any thought? If you haven't, let a practical air-brake man offer the suggestion that you investigate thoroughly, personally if necessary, and see if any care is being given the brakes. See if you are paying other roads for work that you hire your own men to do. See if poor men are costing you dollars to maintain brakes where cents should do the work they are doing. An intelligent move to care for brakes now will save thousands of dollars later on. Don't think that this article is based on fiction or imagination; for, if necessary, I can call the names of the roads where the kind of work mentioned above is being done.

In conclusion, I desire to give credit where credit is due. The North Carolina & St. Louis Railway are taking proper care of their brakes, as I have mentioned before. It may be of interest to add that none of the trouble herein mentioned is encountered on their own cars. I do not take their word for that, understand. I have investigated. I am free to say that they have the best organized force of air-brake men in the eastern part of this country. I make no exceptions. They "use their heads first and their hands afterwards"; and when they go after a defect they know what they are going after. The management is directly responsible for this. Orders, intelligent orders, are issued and are lived up to. That is the secret of the whole business.

ROBERT BURGESS.

Atlanta, Ga.



PISTON TRAVEL RECORDER FOR AIR BRAKES. DESIGNED BY FRANK ROBINSON, BANGOR, ME.

Proper Release for Passenger Trains.

Editor:

I was asked the other day by an old and experienced engineer why it was that his train would sometimes "crawl along on him," and sometimes stop with a slight jerk when he made it a point to always release at the same time—at about the last turn of his drivers.

In putting this question to various classes in the instruction car I found that the answers were divided between two causes, viz.: "Because he had a shorter train at one time than he did at the other" and "Because one train may have cars of longer piston travel than another train."

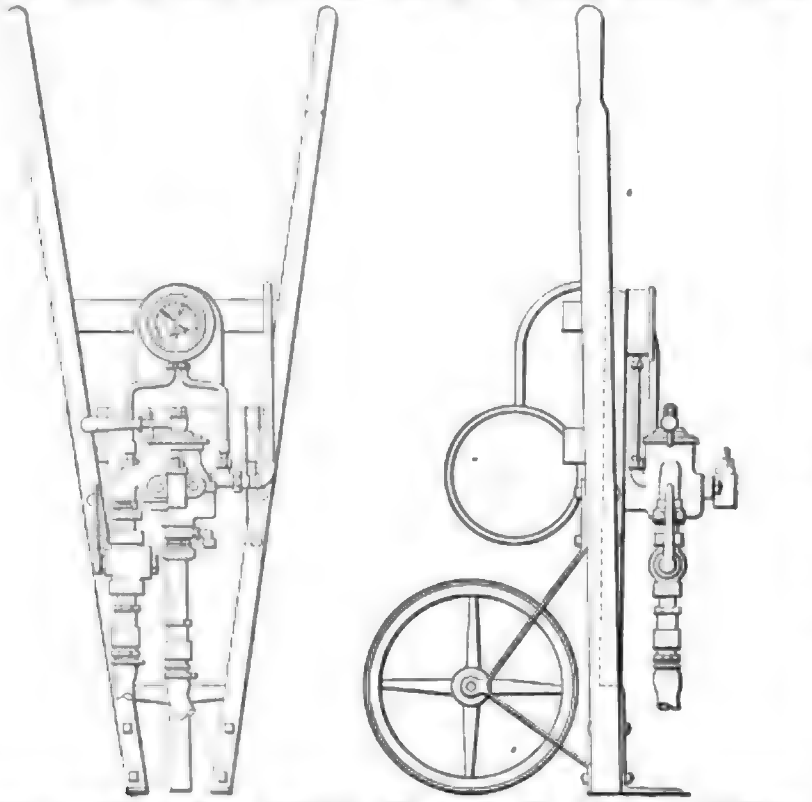
Now, it will be clear to you and all engineers that these two replies are true as regards handling different trains, but neither of them applies to the case in question. We all know that any experienced engineer in making his first stop gets the "feel" of his train as to its stopping power and how quick it releases, and gages his after stops thereby. But the question to be answered is: "Why will the brakes on the same train let go the wheels quicker at one time than at another when we are shown that the triples move just as quick or a little quicker for a heavy (proper) reduction than for a light one." The length of time it takes the small port in the triple valve to exhaust the air, or most of it, from the brake cylinder depends upon how many pounds pressure there is in the brake cylinder at the time the release is made. This depends upon the strength of the application.

For example, suppose the engineer has made three reductions of 5 pounds, one after the other, which makes a total application of 15 pounds, and puts about three times this pressure, or 45 pounds, in the brake cylinders as he comes to a stop. He must now release several seconds before the train stops in order to get most all of this 45 pounds out of the brake cylinders, or else there will be a reaction of the truck springs on each car, causing a disagreeable lurch.

But suppose at the next stop he makes a much lighter application or his first application is going to stop the train too quickly, and he then releases and applies six or eight pounds on his second application. Now, he must hold the brakes on until the train comes almost to a standstill, or it will "run" on him, because the triples exhaust this light cylinder pressure (only amounting to 10 or 15 pounds) very quickly.

This understanding has been of considerable help to many of our runners, who appreciate that it is a difficult matter to make a proper release every time on a passenger train. Hence I give it to your thousands of readers for what it is worth.

E. W. PRATT,
Gen'l Air Brake Inspector, C. & N. W. Ry.
Chicago.



PORTABLE AIR-BRAKE TESTING APPARATUS USED ON DULUTH, MISSABE & NORTHERN RAILWAY AT PROCTOR, MINN.

The Proper Manner of Making Terminal Test.

Editor:

The terminal test should be used when the train has been made up and the engine is coupled on.

A terminal test means: Set the brakes from 70 pounds pressure, by an 18 to 20 pounds reduction, service application, at the engineer's valve; Inspect all brakes to see if all are set; Release by engineer's valve and see that all brakes release.

If cars are added or set out, as in switching, it is necessary to make a test. Brakemen or inspectors should see that cars added will apply, as well as to know that all cocks are open and a continuous train line opening exists throughout the entire train.

Another way used to see that air is cut in is to leave the air set on the train when uncoupling. On returning to train it is argued by some that you have to cut in or the brakes won't release. The objection to this is that brakes might leak off while gone, or that on cutting in a leak is found in coupling; after leak is found the cocks are closed, leak is repaired, but the test is spoiled.

Another way used to test brakes is to open angle cock at back end; if brakes set and release on last car, they will be considered to be cut in by some people. A case of this kind happened only a few days ago. An excursion train was made up at passenger station, charged up and brake set by angle cock, brakes set and released (except driver and tank brake). Parties making test considered it a good one.

The train pulled out and ran over a railroad crossing. Nothing set but the driver and tank brake. Inspection revealed the signal and train hose crossed between tank and first car. The person making the coupling said he had to pound them together. The signal line would charge the brakes and they would set and release from cock at back end.

The train line blow at engineer's valve would deceive the engineer in this case, as he would be reducing the volume of the signal line for the length of train, although a ¾-inch signal line would not blow quite as long as a 1-inch train line.

Better men than any of us have forgotten to open an angle cock; so always *test brakes* and *be sure.*

LEROY M. CARLTON.
Cincinnati, Ohio.

Manufacturer vs. Railway Repairs on Triple Valves.

Editor:

I am very glad to see the subject of the triple-valve packing ring so ably discussed by Amos Judd in the November number. I would like to add that the Nashville, Chattanooga & St. Louis Railway found out some time ago that the packing ring could not be fitted in a triple cylinder by the machinery which we have in the shops, and that a round hole could not be bored with the lathe. And we have the best and most modern machinery at that. We therefore send all our triple valves to the manufacturers to be repaired, and find by actual figures that the expense of repairs is one-third less than when the work was done at the shops, and is far more satis-

factory; for the valve comes back as good as new.

While we have the subject of triple-valve packing before us, I would like to add that it is very hard to get the plugs in angle and cut-out cocks tight. By sending angle and cut-out cocks to the manufacturer it will be found that the work will be done much cheaper and the valve will be as good as new. This has been our practice for three or four years past, and it has proven less expensive and far more satisfactory. OTTO BEST.

Supt A. B., N., C. & St. L. Ry.

Nashville, Tenn.

Adjusting Brake Power to Load.

Editor:

The question has arisen here why air brakes cannot be made to hold on loaded freight cars.

The class of cars we use here weigh from 28,000 to 34,000 pounds empty, being of 60,000 capacity and weighing about 90,000 pounds loaded.

Brake levers and piston travel adjusted to hold 100 per cent. empty will only hold 33 per cent. loaded, and on a good many cars with brake-beam hangers attached to body of car the load in the car compresses the springs, letting brake shoes lower down on the wheel. This, of course, makes piston travel longer, therefore braking power less.

I have never seen anything in regard to this matter in any railroad journal, and would be glad to hear from someone on this subject H. H. BROWER.

Dunnelton, Fla.

[We fear you do not read your LOCOMOTIVE ENGINEERING as carefully as you should. A lengthy and detailed description of such a device is given, with illustrations, on page 453 of October number. —Ed.]

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(79) W. L. E., Port Jervis, N. Y., asks:

How long will the air brakes on seven coal cars stay set after the engine has left them on main track, 40-foot grade to the mile? A.—The time depends entirely on the condition of the brake cylinder packing, train pipe and other parts of the brake system. The air should never be used to hold cars after the engine is cut off. If the air brakes are left set, bleed them off and set hand brakes.

(80) J. R. B., South Easton, Pa., writes:

I notice on one of our engines here a different kind of a feed valve attachment on one of the engineer's brake valves. It looks different from the others. Is it any different and in what way? A.—This is a new design of feed valve, and is not yet out of its experimental state, and is not being sent out with new brake valves. Instead of having a check valve to close off the supply to the train pipe, a slide valve mechanism is used. So far, the new device has worked quite satisfactorily.

(81) R. M. A., Brainerd, Minn., writes:

Is the double governor and double-feed valve attachment like what is used on high speed brakes used much on freight trains, and does it give any trouble? A.—This device, or schedule U, as the W. A. B. Co. catalogue it, is used on quite a number of mountain roads where empty cars are hauled up and loaded cars down. By simply turning a small cock the device is made to carry standard pressure up hill and higher pressure down. It is working entirely satisfactorily as far as we can learn.

(82) H. L. H., Pensacola, Fla., writes:

In reference to question 346, page 58, in the "Air Brake Association's Progressive Questions and Answers," how could I distinguish which one of the triples in the "original five cars" that is causing the trouble? A.—Cut out the fifth brake at the cross-over pipe and then make an application in the service position. If the brakes set in the emergency you have not yet located the defective brake. So cut in the fifth car and cut out the fourth, and so on until you are able to make a service application and not get an emergency. The car that is cut out when a service application gives a service is the one having the defective brake.

(83) R. H. S., Brooklyn, N. Y., writes:

What causes the front brake shoe on right side and back shoe on left side of a push-down driver brake on a four-wheel switch engine to wear out the quickest? The hardest braking is done backing up. A.—In the case you mention, if the brake is a cam or spread type, the back brake shoes will do the greater braking, and will consequently wear faster. If the brake is of the outside equalized kind, all shoes should wear alike, providing the angle of the hangers are the same and the rubbing surfaces of the shoes are equal in area. This difference may not be great enough to be noticed. Again, one shoe may be softer, and will wear more rapidly than the others, regardless of position.

(84) R. H. S., Brooklyn, N. Y., writes:

What caused driver brake to apply while running, with brake handle in full release, a service stop having been made shortly before? The triple valve in good condition; also train line. Brake could only be released by opening bleeding cock and auxiliary. A.—This would happen if the piston travel on driver brake were short and on tender brake were long, and the air pump stopped or pumping very slow. A small main reservoir or one with much water in it would aggravate the case. After a service application and release, the driver brake would recharge quickly, having less air to replace, while the tender brake would take longer, having more to replace. Thus, the pump and main reservoir not sending air into the train pipe as fast as the tender triple used it out, the train pipe pressure would be lowered, due to the drawing of the tender triple and auxiliary, and thus set the driver brake.

(85) A. J. F., Canton, O., writes:

What are the objections to using the special driver brake triple valve, Plate F25, in connection with 10-inch brake cylinders and a 12x33-inch auxiliary reservoir? A.—The Plate F24, the smaller and ordinary plain triple is amply large enough for a 10-inch brake cylinder and 12x33-inch auxiliary reservoir. The Plate F25, or larger plain triple, has larger ports and passageways, and is therefore adapted to larger cylinders and auxiliary reservoirs. The large plain triple is adapted to large brake cylinders and auxiliaries on engines and tenders in a like manner that the large special quick-action triple is suited to large cylinders and auxiliaries on heavy passenger cars. The large triple on a small cylinder would permit too rapid recharging, too quick release and too sudden application.

Mark Twain's White Duck Suit.

Some years ago Samuel L. Clemmens, known to every American reader as Mark Twain, had occasion to take a trip over the Lackawanna Railroad from New York to Elmira. This journey led him across the beautiful meadows of New Jersey, up into the Blue Ridge Mountains, along the tops of hills and mountains with an occasional dip into the valleys, the train most of the time skirting the picturesque Morris & Essex Canal, the magnificent Delaware River or the beautiful Susquehanna River. It led him through Delaware Water Gap, one of the most magnificent natural scenes on the American continent, where mountain, cloud and water literally meet. It led him through the busy coal mining region of Pennsylvania, and with it all he was delighted. Arriving at Elmira he sent the following telegram to a friend who had escorted him to the station in New York: "Left New York on Lackawanna Railroad this morning in white duck suit, and it is white yet." This testimony of Mr. Clemmens to the cleanliness of the Lackawanna Railroad is no fancy of the humorist's brain. The road burns anthracite coal, and there is, therefore, no smoke, and its road-bed is rock ballasted, hence there is no dust. Mr. Twain's white duck suit was white at the end of his journey because those elements of railroad travel which cause one usually to desire a bath immediately after leaving a train, are entirely wanting.

On many engines the air-pump exhaust is now being piped to the steam or exhaust passages in the cylinder saddles, while a number are being so equipped as to throw the exhaust at will into the smokebox, exhaust passages, open air, or use it as a feed-water heater.

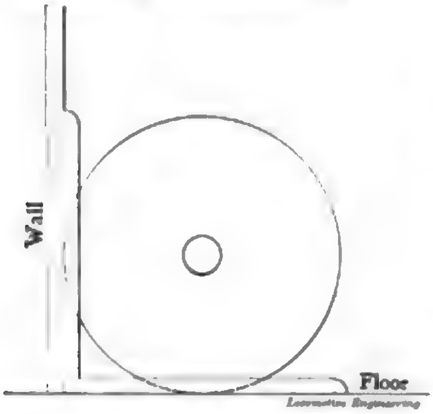
Racks for Tools and Materials.

Probably the most noticeable feature which strikes the eye of a visitor to the New York Central shops at West Albany is the number of racks for both tools and material. Best of it all is they are used, too, and the presence of racks means the absence of the aforesaid tools and materials on the floor and in other unsightly places.

The work is divided up into departments and reduced to a manufacturing basis as far as possible, which is a long step in advance of the old railroad shop method.

It is pretty safe to say that we saw nothing on the floor in the way. There are racks for injectors being repaired, for air-brake work, for pipes, steel rods, tools, dome covers, whistles, heavy gages and other tools. Some of these are worth noting closely, and in fact all can be used in nearly any shop to advantage.

The rack for dome covers is a simple



RACK FOR STEAM CHEST DOME.

affair, and yet holds them easily and safely, besides taking little room and being easily get-at-able. The rack is on the floor and the covers are easily rolled in and out. This is quite a question on heavy work, as racks are sometimes made so as to be more of a nuisance than anything else, from being hard to get the work into or out of.

The rack for the throttle pipes was quite ingenious and simple, as will be seen from cut. The novel feature is the bail or hoop which simply drops into the hooks on each side and holds the pipes safely.

Aside from the convenience and time-saving due to having things where they can be found and are out of the way, it is a constant example of neatness to both workmen and visitors, and is to be commended.

Racks for material vary according to its nature, but it is all handled in some way and kept together where it can be readily found when wanted. One rack noticed was an inverted "V," made of about inch pipe. The ends were flattened for feet and hooks placed on the outside of both pipes. This was used for bars, wrenches, etc.

In the tool room the same idea prevailed, and all the small tools, such as reamers and taps, are kept in what may be called cupboards or closets. Some of these have the regular hinged door, while in the smaller ones on top the door lifts up and is slid back into the top out of the way. These keep the tools quite free from dust; and as they are plainly marked, the tool maker or keeper can easily find the ones wanted.

They have a very complete system of gages—most of them solid—and some of which we may illustrate later.

Doc Has Quit Kicking.

BY B. C. CONGER.

Although my friend Doc has not had anything to say for some months that the readers of LOCOMOTIVE ENGINEERING have heard, he is still on earth, doing business at the old stand, but not exactly in the same manner.

When I met him the other day, he was very quiet, and it took him a long while to get started; but when he did begin, it was after this manner:

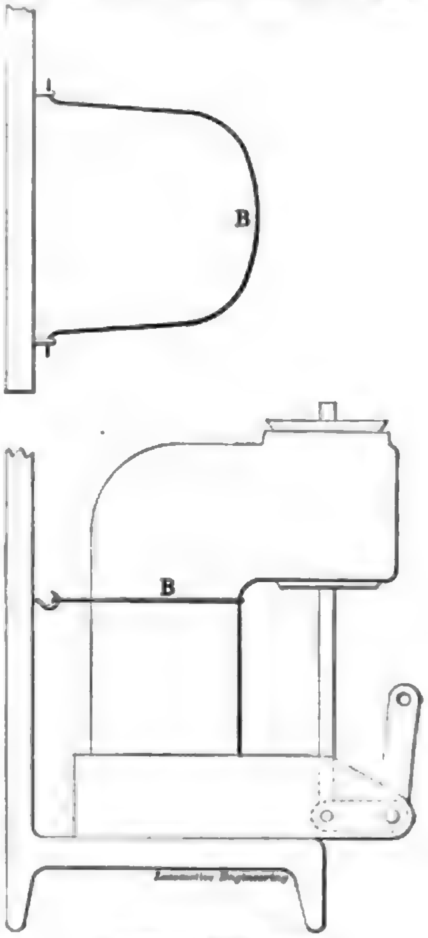
"I used to be one of the worst kickers running an engine in this part of the State, but I have got over it. When I began to learn a few new facts about an engine, and a thirst for more facts began to make the inside of my thinking cap get dry enough to crack open a little, one of the first things that struck me was, that a good deal of kicking about how the work was done came from the men who had the poorest idea of what a real good job was. I used to kick because the time-card was too fast, or because the engine was not good enough; but when it began to dawn on me that the best reason for wanting a good man on my job was the speed of the train and the size of the engine, which made it a hard job to handle, I concluded that it made my situation more permanent and my steady pay more certain.

"The ignorant are ordinarily the worst kickers; it don't make any difference whether it is an officer or an engineer.

"The other day the general superintendent called me up about losing some time with our Limited, which was delayed fifteen minutes fixing a hot driving box, only ten miles out from the end of the run. He asked me if I could not get a train in when so near the end of the trip, without stopping fifteen minutes to fix a box. Says he: 'I won't kick about it this once, for the card is fast, the train heavy, and I know you have had very little trouble for a long time. We appreciate good work done by the men; but you know the reputation of the road suffers when these delays occur.'

"I told him I thought every care had been taken that was necessary, but would try and locate the trouble, and if it was in my work, I would try to make it O. K. Now, that sort of a talk encourages all hands, if it is followed up.

"I concluded that water pipes, leading to the boxes, that gave the most trouble from getting hot, would help out this matter, and tackled the master mechanic for them. Says he: 'Not any water pipes on engines here.' Says I: 'Ain't they a good thing?' 'Well, maybe so,' says he; 'medicine is a good thing for a sick man, but you don't need it for a well one or one that has got a very small trouble. You don't keep a doctor sitting around the house, waiting till a well man gets sick. You have the man take good care of him-



THROTTLE PIPE RACK.

self while he is well, and he won't get sick as often.' Well, now, Clint, that argument floored me for a minute, and the Old Man see it plain enough. 'Well,' says I, 'when you have got only that one man around the house, and things all stop when he gets sick, a little medicine comes handy. That is the case with an engine on the fast train. When she gets sick on the trip with a hot box, she is like the sick man when the doctor comes and has no medicine to give him. The doctor feels sorry, looks wise; the sick man gets well maybe, or maybe not.

"'I will be the hot-box doctor, and you give me the water pipes, then I will guarantee to get in nearer on time. You can doctor the box as you please after we get in the roundhouse.' The Old Man laughed

at that and says, 'All right, come along and show us how you want it done; but mind you, if you give the cold-water medicine to a cool bearing, I will take your diploma away from you.'

"If I had kicked about the pipes and hot boxes, there would be no water pipes on the engine.

"Just the same way when the compounds first came here; some of the men that were entitled to them kicked against them so hard that they gave them to other men. Then when the compounds were put on the good runs—and that is where all our compounds went—the kickers lost their good runs and had to get along on the other runs. I took one of them; went to work to learn how to handle her, and it was like learning the trade all over again. Now that I have got used to her, it is no harder work to run one than a simple engine of the same size. I figured that if they had bought one to use on my run, I could run her if anyone else could.

"I tell you what it is, Clint—while I have no great love for compounds as compared with simple engines of the same size, they are here at work, and if as much time is spent learning all about them as we have spent on the air brake, we can get along just as well. Every new thing gets opposition from some quarter at first. I am not going to kick till it gets so certain a case that I am justified."

Doc is getting to take things a little easier. He is all worked up over the pooling system. When he cools off a little, he will tell us his opinions on that matter.

Color Tests on Railroads.

This important subject was under discussion at the meeting of the New York Railroad Club November 16, being led by a paper by Prof. E. W. Scripture, of Yale University. After going briefly into the theory of color, he explained by diagrams the part played by the red, green and blue on our senses. To the normal color sight these are present to a marked degree. About 95 per cent. of men are normal in color distinction, although there is a slight variance in some colors.

Two per cent. are dichromats, *i. e.*, having but two color sensations instead of three, while another 2 per cent. are also dichromats of a little different breed. The totally color blind are very scarce indeed.

The worsted test, as well as the lantern test, were both discussed. The railroad men seemed to think the worsted tests not practical, while the testers favored it as picking out the kind or grade of defect rather than as a road test. Colored lights, or rather colored glasses fitted to a lamp or to be viewed by light of any kind, were considered about the most practical, as they are what occur in actual practice. It is interesting to note that many who pass the worsted test fall down with the lamps. It was shown that some glass supplied railroads was badly colored, red, for example, having a green tinge, so that to anyone defective in reds it might appear green, and a collision occur. This shows the necessity for both good glass and practically perfect color vision.

There are men who can pick out colors perfectly when near them, but who fail utterly at a distance. This is due to one or all of the color senses being weak. Nervousness also plays an unfortunate part in these examinations no matter what test is used, although it is apt to be worse in worsted, that a man is unfamiliar with. The knowledge that your position—the chance of your earning a living at your trade—depends on your passing the test, can hardly help making a man nervous, and the nearer the test approaches actual conditions the less nervousness is apt to be felt.

Dr. C. H. Williams, formerly of the Burlington, said that in a little less than ten years they found 289 men defective in colors and 644 with poor sight. Part of these were new men applying for positions, so that it does not represent men dismissed from their positions, although the fact remains that this number were debarred from running a locomotive on that road.

The matching of colors was decided to be unnecessary and misleading, and as it is not done in actual practice it is apt to confuse men. What a man does is to decide on the color displayed, calling it red, green or white, as the case may be. Not that he calls it aloud in many cases, but to himself.

In a crowded yard he sees a number of lights, and not only picks them out, but compares the different ones. So the best test shows several colors and allows a comparison.

Fog or rain introduces another element of uncertainty which is especially trying to the man who is color-weak if not color-blind. These conditions are imitated by using smoked and ground glasses over the regular colors.

The work of the New York, New Haven & Hartford road in doing away with white was discussed at length, and generally commended. By their system green is safety instead of caution, and orange is used as a distance signal in place of green. Red, of course, remains danger as before. Mr. C. Peter Clark, the general superintendent, has devoted much time to this in the endeavor to get a shade of orange that would be satisfactory, and the engineers seem to have welcomed the change.

Mr. Potter, however, had just returned from examining these signals and did not think them entirely satisfactory. The men got along with them and welcomed the change to a positive and distinctive color for safety, but the orange was not safe under all conditions of color vision. To some forms of slight color-weakness they will appear red and indicate danger. This, of course, is not apt to cause accidents, unless by blocking the line. To others they may have a greenish appearance and be considered as safety instead of caution.

Mr. George L. Fowler spoke of the Northern Railway of France using yellow as safety several years ago. He did not know whether this was still the practice or not.

Both Prof. Scripture and Dr. Williams spoke of some color defects as being caused by excessive use of tobacco or stimulants, and for this reason advocated an examination every three years to see if any changes had taken place in the color vision.

This gave our friend, M. N. Forney, a chance to get in some telling shots on his smoking friends, by warning them that if they didn't stop smoking in the meetings, and elsewhere, they might become color-blind.

A number of years ago one of the professors of the Lehigh University devised a parabolic reflector to go on the blade or arm of the semaphore. This reflected the light from the lantern along the whole length of the blade and enabled the engineer to determine the signal by *position* instead of color, the same as in the daytime. If we remember rightly, it was arranged to use both red and white lamps, the former showing when the arm was at danger and the other when dropped. This showed a red arm in one position and a white at the other, but it was not necessary to distinguish color to read the signal. It also obviated the danger of confusing signal lights with ordinary house or street lamps, which is, of course, the main object in using a positive safety color as green..

As this has never come into practical use, we presume there were serious objections to it, either as to cost or in its operation; but the plan of determining signals by position rather than color certainly has much to commend it, if it can be made practical. This would reduce the eyesight test to one of clear vision without regard to color.

One of the chief difficulties in the way is the fact that lights lose shape at a distance, and a square lamp will look like a round one at no great number of yards away. Whether the lighted semaphore arm is open to this objection or not can best be answered by those who have had actual experience with it.

Recently a section foreman sent in the following unique account of an accident: "MacWhorter's bull sthruck at the long siding by No. 4 and killed. We found him alongside the thrack, and as he was not quite dead then, I borrowed a gun and shot him three times, killing him 'again.' Dennis Sulivan then sthruck him another blow on the head with a pick and finished him. The bull is now dead.

"Signed, M. DONNIVAN."

PERSONAL.

Mr. M. Innes has been appointed assistant general superintendent of the Arizona & New Mexico at Clifton, Ariz.

Mr. P. T. Hackett has been appointed superintendent of the Washburn, Bayfield & Iron River, with office at Washburn, Wis.

Mr. John Cullinan has been appointed master mechanic of the Columbus, Sandusky & Hocking; headquarters, Columbus, O.

Mr. Fred T. Harris has been appointed assistant superintendent of the first division of the Denver & Rio Grande at Pueblo, Colo.

Mr. Frank H. Brackett has been appointed roundhouse foreman of the Fitchburg Railroad at Worcester, Mass., vice Mr. H. Blaisdell, resigned.

Mr. John King has been appointed master mechanic of the Chattanooga Southern, in place of Mr. H. T. Ellison, resigned; headquarters at Chattanooga, Tenn.

Mr. A. C. Hone has been appointed superintendent of motive power of the Evansville & Terre Haute at Evansville, Ind., vice Mr. John Torrance, deceased.

Mr. J. C. Martin, road foreman of engines of the Southern Pacific, has been assigned to duties on the Western division; headquarters at West Oakland, Cal.

Mr. J. C. Fisher has been appointed master mechanic of the Southern Missouri & Arkansas at Cape Girardeau, Mo., succeeding Mr. A. W. Quackenbush, resigned.

Mr. J. R. Rogers has been appointed general superintendent of the White Pass & Yukon, vice Mr. F. H. Whiting, resigned; headquarters at Skagway, Alaska.

Mr. W. G. Edgar has been appointed general foreman of the machinery department of the St. Louis Southwestern at Commerce, Texas, vice Mr. J. W. Hall, resigned.

Mr. E. C. Hoffman has been appointed master mechanic of the Breckenridge division of the Great Northern at Breckenridge, Minn., in place of Mr. J. C. Nolan, transferred.

Mr. L. A. Shepard, mechanical engineer of the Philadelphia & Reading at Reading, Pa., has resigned to accept a position with the Sterlingworth Railroad Supply Company, Easton, Pa.

Mr. W. J. Hemphill, master mechanic of the St. Louis, Peoria & Northern at Springfield, Ill., has resigned to accept a similar position on the Chicago & Alton at Bloomington, Ill.

It is reported that Mr. W. G. Wallace, of Baraboo, Wis., traveling engineer of the Chicago & Northwestern, is coming to the Central Railroad of New Jersey as road foreman of engines.

Mr. F. O. Walsh has been appointed master mechanic of the Atlanta & West Point and Western of Alabama, with office at Montgomery, Ala., in place of Mr. R. H. Johnson, resigned.

Mr. W. W. Wheatly, assistant general superintendent of the Brooklyn Rapid Transit Company, has been appointed acting general superintendent in place of Mr. Ira A. McCormack, resigned.

Mr. W. N. Jones, assistant superintendent of the Montgomery division of the Mobile & Ohio, has been made superintendent of the Mobile division, including branches; headquarters at Artesia, Miss.

Mr. H. W. Byers, superintendent of the Erie & Ashtabula division of the Pennsylvania, has been appointed superintendent of the Cleveland, Akron & Columbus, with office at Akron, O., vice Mr. J. J. Henry.

Mr. G. L. Potter, superintendent of motive power of the Northwest system of the Pennsylvania lines west of Pittsburgh, has been appointed general superintendent of motive power, with headquarters at Pittsburgh, Pa.

Mr. J. E. White, foreman of the Mobile & Ohio shops at Whistler, Ala., has been appointed foreman of the roundhouse and machine shops of the Louisville & Nashville at Pensacola, Fla., vice Mr. A. R. Waters, resigned.

Mr. A. L. Kendall, master car builder of the Lake Shore & Michigan Southern at Englewood, Ill., has resigned to accept the position of general foreman of the car department of the New York Central & Hudson River at West Albany, N. Y.

Mr. A. J. Dunn, foreman of the Southern shops at Knoxville, Tenn., has resigned to accept the position of master mechanic of the Atlanta, Knoxville & Northern, succeeding Mr. T. W. Newell, resigned; headquarters at Blue Ridge, Ga.

Mr. William Buchanan, until recently superintendent of motive power and rolling stock of the New York Central, has been presented with an engrossed and illuminated copy of resolutions passed by the Board of Directors on his retirement.

Mr. Jas. M. Jolley, formerly with the Kansas City, Pittsburg & Gulf at Pittsburg, Kan., has been appointed roundhouse foreman of the Kansas City & Independence Air Line and Kansas City Suburban Belt Railways at East Kansas City shops.

Mr. R. H. Johnson, master mechanic of the Atlanta & West Point and Western of Alabama, has resigned to accept the position of general master mechanic of the St. Louis Southwestern, succeeding Mr. R. M. Galbraith, resigned; headquarters at Pine Bluff, Ark.

Mr. B. F. Van Vliet, trainmaster of the Iowa & Dakota division of the Chicago, Milwaukee & St. Paul, has been promoted to the position of superintendent of the Northern division, with headquarters at Milwaukee, Wis., succeeding Mr. J. M. Bunker, resigned.

The following changes have been made on the Burlington & Missouri River Railroad in Nebraska: Mr. A. B. Pine has been appointed master mechanic at the Havelock shops; Mr. F. J. Kraemer has been appointed master mechanic of the Southern division at Wymore, Neb.

Mr. C. A. Sanders has been appointed assistant master mechanic of the Missouri Pacific, vice Mr. J. T. Jones, resigned; headquarters at Fort Scott, Kan. Mr. Sanders has long been a warm friend of LOCOMOTIVE ENGINEERING, and has done a great deal to spread its circulation on the Missouri Pacific.

Mr. Frank Riley has been appointed general foreman in charge of the shops of the Chicago, Lake Shore & Eastern Railroad at South Chicago, vice J. H. Ruxton, resigned. Since the consolidation of the management of this railroad with the Elgin, Joliet & Eastern Railroad, the general headquarters are at Joliet, Ill.

Mr. James Potter, who has resigned as district passenger agent of the Baltimore & Ohio Railroad at Philadelphia, after a number of years of very successful service, to become business manager of the Philadelphia *Evening Telegraph*, will be succeeded by City Passenger Agent Bernard Ashby. Mr. Ashby's appointment comes in the nature of a well-deserved promotion.

Mr. L. R. Pomeroy, so well known as agent for the Latrobe Steel Company and for the Cambria Steel Company, has resigned to accept a position in connection with the Schenectady Locomotive Works. Without having special engineering training, Mr. Pomeroy is one of the most accomplished mechanical engineers in the country, and we feel certain that his services will prove of great value to his new employers.

Mr. Henry Honn, a locomotive engineer of the Lake Shore & Michigan Southern Railway, has been promoted to an assistant traveling engineer, with headquarters at Elkhart, Ind. He has been with this company as an engineer since 1870, about ten years of that time on the Lansing division. The appointment took effect November 1. This is in the nature of a new departure on this system, having assistant traveling engineers.

Mr. Orville H. Reynolds, who will be pleasantly remembered as the editor of the Car Department of LOCOMOTIVE ENGINEERING, has accepted the position of mechanical engineer at the Dickson Locomotive Works, Scranton, Pa. Mr. Reynolds is a machinist who, by the aid of night schools and self-denying efforts, raised himself from the bench to the drawing office, and thence to the position of mechanical engineer. On railroad mechanical matters he is one of the best informed men in the country.

The following appointments have been made on the Lake Shore & Michigan

Southern: Mr. Charles R. Tunks has been appointed master car builder at Adrian, Mich., vice Mr. F. O. Bray, resigned. Mr. Tunks' jurisdiction will extend over the Detroit division, Lansing division and the Michigan division east of Sturgis and Goshen. Mr. LeGrand Parish has been appointed master car builder at Englewood, vice Mr. A. L. Kendall, resigned. Mr. Parish's jurisdiction will extend over the Western division, Kalamazoo division and the Michigan division west of and including Goshen and Sturgis.

Mr. W. O. Thompson, engine despatcher for the Lake Shore & Michigan Southern Railway at Elkhart, Ind., has resigned that position to go with the Hancock Inspirator Company, of Boston, as a salesman and expert. His territory will be the Eastern and Southern States. The representative in the West for several years and now is Mr. Frank P. Smith. Mr. Thompson had considerable experience in the locomotive department, having been promoted to engineer in 1879 on the Fort Wayne, Jackson & Saginaw Railroad. He went on the Lake Shore as an engineer in 1882, was promoted to traveling engineer in October, 1890, and to engine despatcher in 1893. Mr. Thompson is best known as the secretary of the Traveling Engineers' Association, which position he has held continuously since January, 1893. He was one of the organizers of the association His executive ability and untiring exertions have contributed to the success of the association, which now numbers an even three hundred members.

In our personals, page 504, November, 1899, we mentioned Mr. George R. Brown as being formerly connected with the Beech Creek Railroad. It should have been the Fall Brook.

Mr. W. S. Templeton, general foreman of the Northern Pacific at Bakersfield, Cal., has resigned to accept a position as master mechanic of the Guatemala Central; headquarters, Guatemala City, Guatemala, C. A.

Among orders recently given out by the New York Central for new locomotives are five with the "Vanderbilt" boiler. The engine already in use with that form of boiler is doing so well that the management feel inclined to believe that the corrugated furnace is likely to become a permanent improvement for locomotives, just as much as it is to-day in marine boilers.

The Chicago Pneumatic Tool Company have issued a circular letter giving particulars of a decision lately in the United States Court at New Haven, Conn., which sustains the validity of the patents protecting Boyer pneumatic tools. The decision is considered of great importance and will enable the company to effectually protect their rights against those who are inclined to infringe their patents.

Piece Work and Pooling Engines.

At the November meeting of the Western Railway Club these two subjects were discussed in a very animated manner. The papers, which are too long for our columns, are practical views of these matters.

Mr. R. T. Shea, of the Hannibal & St. Joseph Railroad, author of the paper on "Piece Work in Railroad Shops," opened the discussion by a few brief remarks on the salient points. He was followed by J. F. Deems, master mechanic, Chicago, Burlington & Quincy Railroad, who spoke at some length. Having six or seven years' experience with piece work in railroad shops, he is impressed with the fact that this subject reaches farther than we realize. It is an important factor in the evolution of better methods in shop work. It is an American plan and will make this country the workshop of the world. He regards the profit-sharing system as the ideal one, and that any profit shown in lessened cost of making an article should be divided between the company and the men, instead of cutting the rate till piece work paid no more to the man than day work. Piece work should pay the most. He took the stand that the average man's work should be the standard instead of that of the best workman. He believes that it encouraged the individuality of the workman, so that each did his best.

Mr. Miller, superintendent of motive power, Michigan Central Railroad, did not think anything was gained or saved by the piece-work system over day work. Figures for each method showed that their work was done cheaper by day work. Machine shops which make specialties or have enough of one style of parts to manufacture could possibly do better at piece work; general repair shops could not.

Mr. Thurlett, of the Pacific Boiler Works thought the men were too apt to hurry the work through and not do their best work. Besides, it made trouble, and the man who suffered by it always complained.

Mr. G. W. Rhodes believes in it, and cited instances where it helped both the men and the companies. Piece work should pay the workman more than day work, and should be fairly allowed. The price should not be cut when it was seen that the men were making more than at day work.

Mr. Henderson, Chicago & North Western Railway, commended the plan for manufacturing new work; it should be on the profit-sharing system.

Mr. W. S. Morris, Chesapeake & Ohio, believes that conditions govern this matter. They have not found it necessary or advisable to change from day work to piece work.

Mr. Sinclair, LOCOMOTIVE ENGINEERING, said that for the reproduction of the same kind of articles it paid; for repairs it did not. If all the conditions were fair and honest between the men and officials, it would be ideal. If the rates were cut as soon as the men began to do large amounts of work, it made trouble at once.

Mr. Chase, Hannibal & St. Joseph, commended the piece-work plan, from experience, in car-shop and roundhouse work.

Mr. Delano, superintendent of motive power, Burlington road, commended it.

All the speakers laid especial stress on the fact that it must be so arranged as to pay higher wages than day work, and that the increased output would pay the company's share.

The discussion on the paper on "Pooling Engines" was opened by the author, M. E. Wells, Burlington & Missouri Railroad. The paper was strongly in favor of pooling. Mr. Conger, of LOCOMOTIVE ENGINEERING, said that pooling engines needed a shop organization to take care of the engines as soon as they came off their runs and get them ready for the next trip; that the men who run the engines should not be called on to do this. If oil delivered to the men was weighed, the exact amounts used by each man could be more accurately determined than if cans were filled by measure. Mr. Henderson explained the method used on the Norfolk & Western when he was there; the oil delivered was weighed and an account kept with each man, not with the engine.

Mr. Bentley, Chicago & North Western, spoke in favor of pooling, but the plan should be systematized.

Mr. W. G. Wallace, of the same system, said that pooling engines is coming, and we want to start it right. Inspection of engines and making needed repairs are the main things.

Mr. McKenzie, Nickel Plate, said he would not pool passenger engines, as he would not expect as good service.

Mr. Graham, Cleveland, Lorain & Wheeling, brought up the question of keeping tools on pooled engines; that the inspector should look after tools each trip. He prefers double crewing engines to pooling.

Mr. Bentley explained that they have small tool boxes for each engineer, that were carried from one engine to another.

Mr. Manchester said that with 450 crews running into one point, as they had at Milwaukee, they could hardly provide 900 lockers for the men to store their belongings in between trips.

Mr. Rhodes paid a very neat and deserved compliment to the authors of the papers, who were employés and not officials. The papers showed that the men and officers are getting closer together.

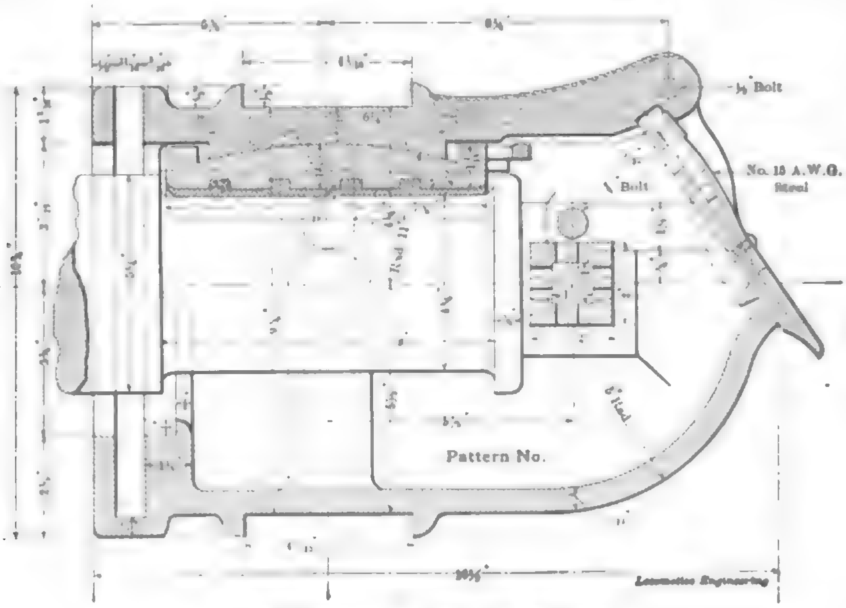
While most of the speakers approved of the pool system and had able arguments in its favor, yet the other side was ably represented. The tendency is for the officials to stand up in favor of the pool system, while the trainmen oppose it. Our correspondence columns testify that the men, as a rule, are opposed to pooling.

Improved Oil Box and Bearing.

The oil box and bearing shown in the annexed engraving have recently been invented by Mr. Pulaski Leeds, who has always opposed the Master Car Builders' brass and wedge. Writing about the invention, Mr. Leeds says:

"I believe it is a great improvement over both the Master Car Builders' brass and wedge and the common saddle brass, which is nothing more than the arching of the brass so as to give it a circular bearing fore and aft of its length, which will allow of its adjusting itself to any tilting of the box, and at the same time forms the strongest possible shape to prevent the brass curling up at the ends. With the Master Car Builders' brass and wedge you have several different points where inequalities in casting are liable to have the effect of pinching the brass on the journal, and besides this, they have recognized the fact that a brass should have a curved surface, or bearing, either by curving the wedge or curving the brass; but the brass is so light that it will curl up at each end and in every instance the journal wears hollow. I have had a set of these brasses under one of our heaviest tenders and in our fastest train service, for several months, with most excellent results, and believe it to be the best of anything I ever saw. You understand that I cast the top of the box on a chill to coincide with the curve on the back of the brass, and in fact cast the back of the brass on a metal form in the mold so that the two curves are practically coincident and bed themselves nicely. I claim to get all the advantage of the saddle brass without any of the disadvantages of either it or the Master Car Builders'."

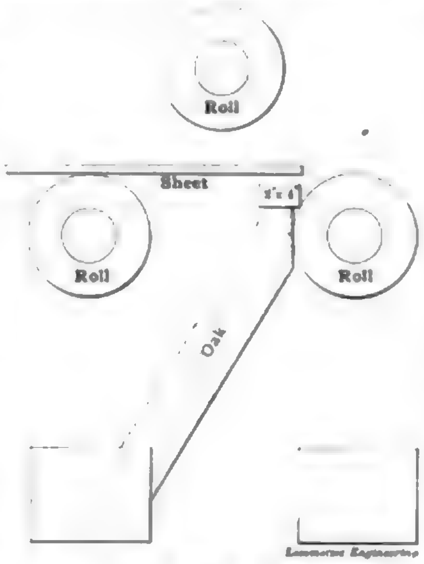
In another letter received from Mr. Leeds we are informed that he intends adopting the bearing because he is convinced that it will reduce the trouble from hot boxes.



LEEDS IMPROVED OIL BOX AND BEARING.

A Boiler Shop Kink.

In the Santa Fé Pacific boiler shop at Albuquerque they use a device for bending the end of a sheet under the rolls, so it will be of the same circle as the rest of the sheet, that is worthy of imitation.



BOILER SHOP KINK.

As well known, the end of the sheet where it first starts through the rolls does not get curved at all, and it is necessary to finish it later, generally by hammering into the proper shape.

A long bar of 2 x 4-inch iron is laid next to the lower roll and braced up by a number of wooden supports, so the bar is firmly held up while the edge of the sheet rests on it. The upper roll being forced down by the screws at each end bends the edge of the sheet to the proper radius. The illustration makes this plain. Boiler Shop Foreman Alfred Parfitt is credited with this kink. There are other devices equally ingenious.

To hold a bar or long chisel while cutting off staybolts, a rubber wedge is used, made of a short piece of 3-inch hose. When this wedge is put in, it is flat and thin; after being placed it is inflated with air from a small hose and fills the space, holding the bar firmly in place for each blow of the air hammer.

A small hydraulic jack, with the power furnished by water pumped with an air-brake cylinder, is a very handy device for lifting boilers to block up or turn over. This jack takes up very little room where it is set. A small copper pipe connects it with a water supply attached to an air-brake cylinder, which is out of the way. The piston rod of the air piston serves as the plunger to force the water into the cylinder of the jack. When the weight is to be lifted, the air is turned on and the pressure is carried from the plunger by the copper pipe to the ram of the jack. We will describe this and other labor-saving devices later.

At Elkhart Shop.

Some changes to facilitate the washing out of locomotive boilers are being made in the roundhouses of the Lake Shore & Michigan Southern Railway at Elkhart, Ind. In order to blow off the boilers without filling the pits with hot water and the house with steam, the houses have been equipped with a large drain pipe of wrought iron having branches coming up level with the floor between the stalls, to which the blow-off cocks can be connected, and the water let out of the boilers at any time whether hot or cold.

Overhead is a 3½-inch pipe extending around the house, with a 3-inch pipe coming down between the stalls convenient to attach the wash-out hose to. The pumping machinery has sufficient capacity to maintain a pressure of 100 pounds per inch at all times in this pipe for washing out.

Compressed air is also piped clear around the house, overhead, with branches extending down between the stalls, and 2-inch pipes have replaced the small piping in the heating coils in the pits. The heavy pipes will not be bent or the joints damaged by parts of the engine falling on them when repairs are being made on an engine.

The heating coils on the sides of the pits receive such rough usage that unless supported very strongly they require constant repairs. The use of heavy pipe should obviate some of the trouble.

The Newton Machine Tool Works, of Twenty-fourth and Vine streets, Philadelphia, are so overcrowded with orders that they find it necessary to increase their plant. They are, therefore, about erecting a new building on a piece of property owned by them at Nicetown, for facilitating the filling of orders. A large share of this is due to orders for locomotive tools.

The Lehigh Valley Shops at Sayre, Pa.

The Lehigh Valley Railroad are endeavoring to get their shops to a manufacturing basis, and appear to be succeeding admirably. A recent visit to the shops at Sayre showed great changes over a former one, and there are more to follow. Perhaps the most noticeable is the new car paint shop, which has just been completed. It is a large building of modern steel construction, with saw-tooth roof of six sections. It contains twelve tracks, each capable of holding four cars. Each side of each track is an adjustable scaffold for painters. These are hung between the steel uprights of the building, and are trussed for strength. They are about 27 feet long. As there are seven each side of each track, it makes fourteen times twelve, or 168 scaffolds in all. At the end is the heating apparatus, put in by the Buffalo Forge Company, we believe, and it is a model of substantial engineering. This, as well as the whole of the building, has concrete or cement floors. The hot-air system is used, the ducts branching out and being controlled by dampers. The air is drawn through a large bank of steam pipes which are in a bricked up room, like a vault, and there is also a room beside these pipes which can be used for special heating—almost baking—of anything desired.

Up stairs at this end is a gallery with drying racks for car window sashes and blinds, while down stairs there are racks for seat frames almost without number. The sash racks are rather novel, and one is shown in the sketch.

Inside the ends and both sides of the partitions are cleated, as shown, and the partitions are movable, so as to get any desired distance between them for different sized sashes. These are clamped by the hand screws shown. In the ones seen there were more than three partitions, but this gives the idea.

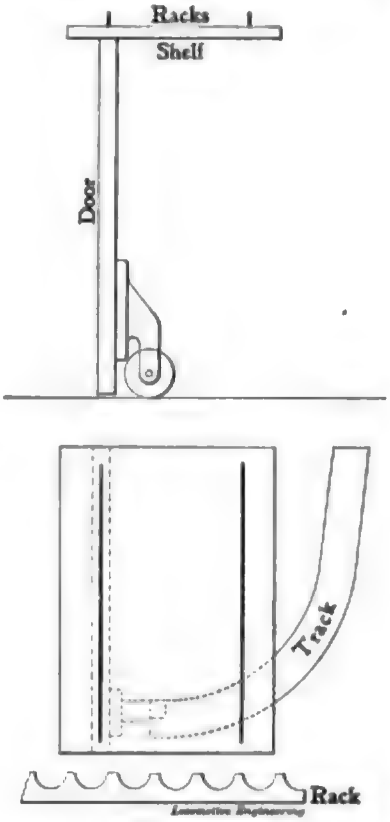
The shops are white inside and well lighted, of course. The roof lights, together with incandescent and arc lamps in large numbers, make it an ideal shop. There is an electric transfer table at one end for reaching any track or yard track.

Opposite this, across the transfer table, is the car shop, which will also be improved, while near is a new cabinet shop for passenger car work. In fact, this will be the car shop of the Lehigh Valley system, and being fairly near the middle of their line from New York to Buffalo, is admirably located for this.

The improvements are not, however, confined to the car department, and we find the erecting shop, with six new stalls, new lathes, planers, boring mills, etc. A new transfer table, also electric, is being put in to serve the erecting shop tracks.

Then there is a new power house, with several direct-connected dynamos and engines. They supply light and power to the shops, and make a very complete plant for this purpose. They also have a new Ingersoll-Sergeant compressor for supplying the ever increasing air hoists and tools they have in use.

The blacksmith shop has been entirely renovated, and the introduction of thirty-two down-draft forges makes it hardly

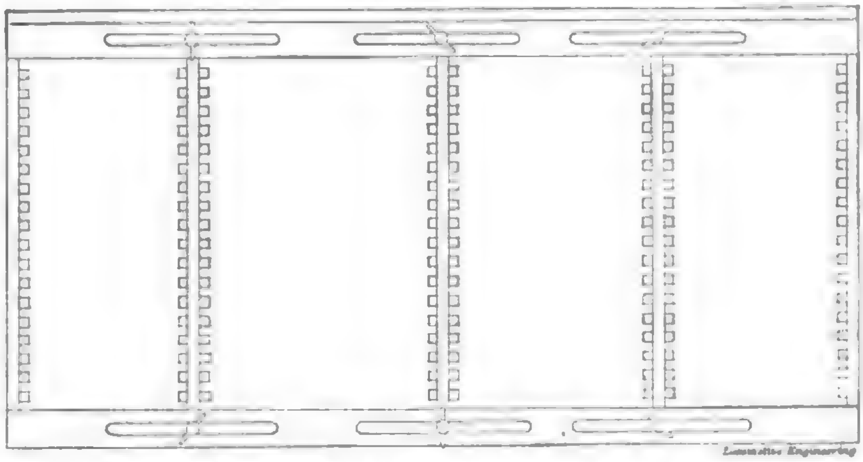


TOOL ROOM DOOR.

seem possible we are in a smith shop, as there is so little smoke and gas. These are from the Buffalo Forge Company, and they are using this as a shining example of their system, as well they may. Beside these are other forges, so that the size of the shop may be imagined. These down-draft forges are ranged in bunches of four, backed so as to form a hollow square in the center. This is filled with a big iron tool rack, so that tongs and other tools are handy for all four fires.

The manufacturing feature is shown strongly when we learn that at Sayre they handle all the boiler flues for the entire system, while at South Easton all the cylinders are bored and drilled, ready for applying. The use of jigs and templates makes this both possible and profitable. Of course, this is not all that is made at either Sayre or South Easton, but it shows the principle, which is certainly the right one, of having each large shop make some portion of the work for the whole road, instead of each shop making everything from a boiler to a valve rod. In the old way it was not possible to systematize work so as to get the cost down where it belonged on account of expense for tools and jigs. Then it was necessary to have these for each shop if cost was to be reduced. Now, by the method described, one shop makes all of one thing for the road, and there is but one set of tools to buy. This makes it possible to reduce cost and is the only way a railroad can really afford to do.

Flues are cleaned here by heating in a special furnace and then plunging into water. This cracks the scale so that it is easily removed, and twelve years' use says that it doesn't hurt the flues in the least. They are cut and scarfed at one heat and the safe end stuck in place, after which they are stacked until a lot is ready for welding. Some shops do it all at one heat, although they cut the ends cold. They are then welded and tested by a combination of steam and air. Mr. Welsh, the general foreman, has rigged a 9½, an 8 and a 6-inch air-pump in series, or compounded them, and in this way has no trouble in getting 160 pounds of air for testing. They also use a hammer test at the weld.

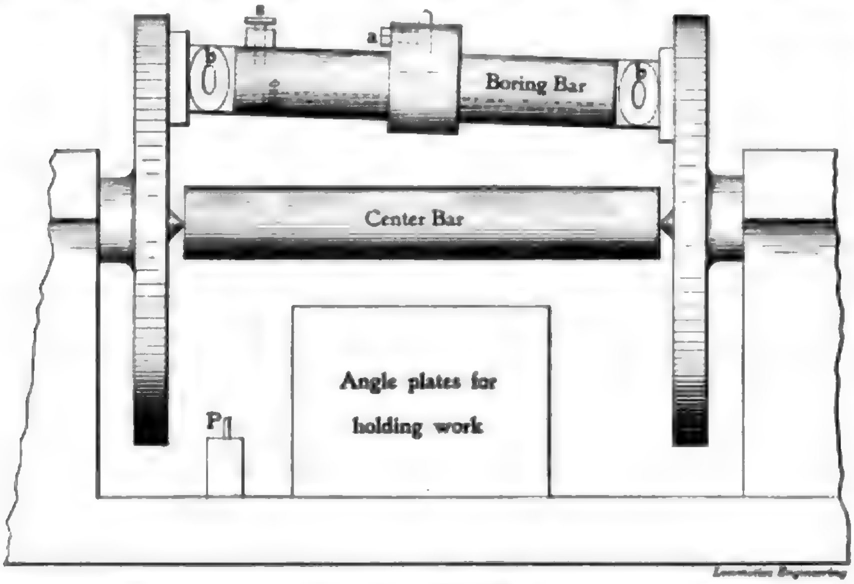


DRYING RACKS IN THE NEW CAR PAINT SHOP AT SAYRE, PA.

The tool room in the main shop has a low door with a shelf top, and on this is a rack for holding tools that are placed there, preventing them rolling on the floor. As this adds to the weight of the door, a support is provided as shown in the sketch. This is a substantial bracket with a wheel about 5 inches in diameter, which rolls on an iron track laid in the floor as shown.

In fact, the sketch ought to make the plan clear.

The men do not come here after tools, but press a button located at a convenient place near them, which works an annunciator in the tool room. The tool boy sees the station, goes there after his order and gets the tool wanted. If he has one to return he carries that back. All the tool checks are kept in the tool room on a special rack, so that none are lost. When the boy takes a tool for any workman one check is taken from the rack and placed in that tool's place, the same as in other shops. The keeping of all the checks in the tool room avoids loss of them from men's pockets, and seems to have advantages over the plan of each man carrying his own.

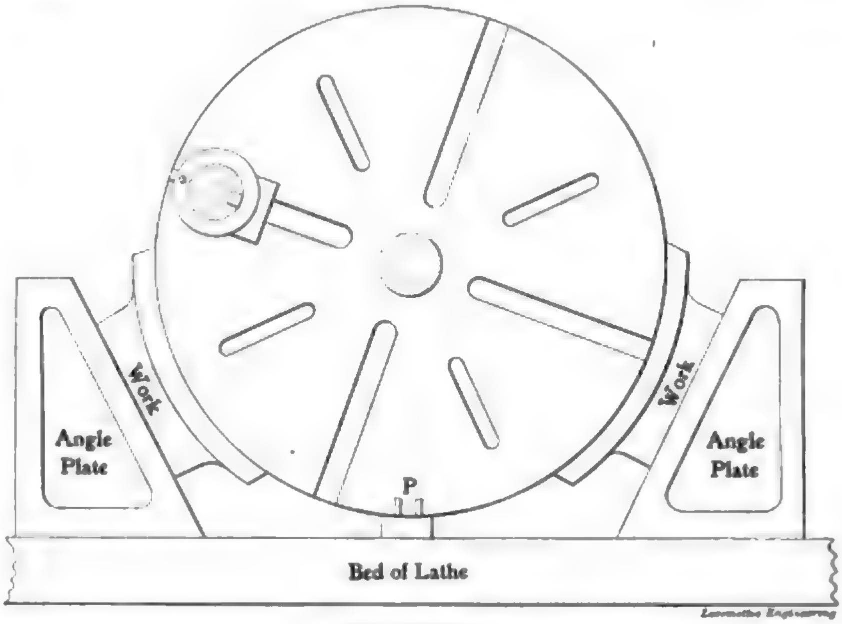


TAPER BORING RIG.

A Taper Boring Rig.

When designers put the dome on the taper course of a wagon-top boiler they evidently do not think of the shaping of the reinforcing ring which must fit the sheet, or that a special boring rig may be necessary.

These rings are usually planed out on a planer having a special head with a circular movement, but the taper has to be treated differently. At the Baldwin works we recently saw a big wheel lathe doing duty as a boring mill for this work in a manner that was both ingenious and extremely practical. A heavy center bar or distance piece was between the center as a brace, and the boring bar bolted by special foot pieces to the face plates at the proper distance for the radius and at the correct angle. The work—and two rings were being bored at a time—was held on angle plates, as shown by end view, and fed into the proper distance. The foot pieces for the bar had two ears or lugs, between which was bolted the flattened ends of the bar *b b*, so that any desired angle can be obtained. The boring bar is of the usual type, although with slight modifications, and the star wheel *s*, striking pins *P*, feeds the tool head along in the usual manner.



TAPER BORING RIG.

At the General Electric Works.

One of the most rapid developments we know of is at the General Electric Company's plant at Schenectady, and even a lapse of six months between visits sees many changes. When the new foundry was opened in March of this year, it was supposed to be ample for some time to come, but a recent visit shows that 240 feet more are being added to it, making a total of 740 feet in one foundry building. They are at present pouring about 80 tons a day and employing in the neighborhood of 250 molders.

Their new machine shop is also in full swing now, and the part comparison plays in our ideas is plainly shown by a view from the center of the gallery, up and down the shop. Twenty-five-foot boring mills, that seem giants in a small shop, appear very ordinary in a shop of this size. A very apt comparison was drawn by Mr. Rohrer, the genial superintendent, who showed by figures that the steamship "Kaiser Wilhelm der Grosse" could just go in the central part of this shop, still leaving the wings for use.

Machine shop work has been largely revolutionized here as in other large shops—but this affords an example of taking the tool to the work, on a scale not dreamed of ten, or even five, years ago. They have an immense bed or surface plate, 20 by 120 feet, bedded solid in the floor. On this is placed and bolted such tools as horizontal boring machines, slotters, special milling machines, drills, etc. These are electrically driven by an independent motor and are fitted with eyebolts or slings for lifting.

Taking a large dynamo field ring, 10, 15 or 20 feet internal diameter, these tools are lifted and placed in position inside and outside, and two or three may be at work on the same casting. It is a new method that has become indispensable in large machine work, and it can be studied with profit by those who want to keep up to date in large machine work. Many mechanical problems are to be solved in a works of this kind, and in the machine-tool department great credit belongs to Mr. Riddel, who has this in charge.

In this connection it may be interesting to note the general dimensions of the twenty-eight locomotives built by them for the Central London Railway:

Total length—30 feet.
Total wheel-base—20 feet 4 inches.
Diameter of wheels—42 inches.
Drawbar pull—14,000 pounds.

Drawbar pull at twenty-three miles per hour—7,600 pounds.

Total weight—42 English tons.

Total height—9 feet 4½ inches.

Each locomotive is equipped with four gearless motors of 200 horse-power capacity each and weigh 12,000 pounds.

The current is generated by six 850 kilowatt three-phase generators, driven by 24-inch and 46 x 48-inch Reynolds-Corliss engines at 94 revolutions.

The voltage of the generators is 5,000 and the current will pass through step-down transformers and rotary converters erected in sub-stations at different parts of the line.

The locomotives will take the current from a third rail by means of the usual contact shoe.

The total length of the railway is 6½ miles.

Influence of American Railroads.

When people wish to know particulars about the business done by railroad companies they cannot find anyone better primed with facts than George H. Daniels, general passenger agent of the New York Central Railroad. The leaders of the International Commercial Congress, which was held in Philadelphia last month, seemed to appreciate this, for they invited Mr. Daniels to address the meeting, and he told them many interesting things which will, we feel sure, be read with interest by the greater congress of our 20,000 subscribers of LOCOMOTIVE ENGINEERING.

Limited space prevents us from publishing the address in full, but we give the following extracts:

AN AGE OF TRANSPORTATION.

One of our great writers has said of this closing period of the nineteenth century, that it is an age of transportation.

Transportation underlies material prosperity in every department of commerce. Without transportation commerce would be impossible.

Those States and nations are rich, powerful and enlightened whose transportation facilities are best and most extended. The dying nations are those with little or no transportation facilities.

RICHEST COUNTRY ON THE GLOBE.

Mr. Mulhall, the British statistician, in his work on "The Wealth of Nations," said of the United States in 1895: "If we take a survey of mankind in ancient and modern times, as regards the physical, mechanical and intellectual force of nations, we find nothing to compare with the United States."

Mr. Mulhall proved by his statistics that the working power of a single person in the United States was twice that of a German or Frenchman, more than three times that of an Austrian and five times that of an Italian. He said the United States was then the richest country in the world, its wealth exceeding that of Great Britain by 35 per cent., and added that in the history of the human race no nation ever before possessed forty-one millions of instructed citizens.

Should Mr. Mulhall revise his figures to-day, the differences would all be in favor of the United States, for in the past eighteen months we have demonstrated the superiority of our manufactures in every direction, and our ability to cope successfully with questions which have hitherto been handled exclusively by the older nations is now recognized by all the world.

RESULTS OF WAR BETWEEN JAPAN AND CHINA.

In an address before the New York Press Association four years ago, I referred to the future of our export trade, as follows: "One of the inevitable results of the war between Japan and China will be the opening to the commerce of the world of fields heretofore unknown, perhaps the richest on the globe," and in urging the members of the New York Press Association to do everything in their power to assist in securing to the United States a portion of the great commerce to be developed between the western nations and these two old countries of the world, I asked these questions:

"Shall the grain in China and Japan be harvested by machines manufactured in the United States, or will the manufacturers of England and Germany supply them?

"Shall the fires in Yokohama and Tientsin be extinguished with engines built at Seneca Falls, or will France or England send their fire engines to Japan and China?

"Will the locomotives to haul the fast mail trains between Yokohama and the interior of Japan and through the rich valleys of China be built at Schenectady, Philadelphia or Dunkirk, or will our Oriental friends and neighbors in the Pacific buy them of our English cousins?"

I predicted that active efforts toward the extension of American commerce by commercial bodies, supported by a liberal and broad-minded policy on the part of our Government in connection with the aggressive action of the transportation companies, would undoubtedly secure to the United States the blessings that come from a great and varied commerce, and I said that the New York Press Association and similar associations all over the country could stimulate a public spirit that would insure the important results outlined.

At that time we had no idea that a war between one of the old nations of the earth and our young republic would be fought; at that time we had no idea that American manufacturers would be furnishing locomotives to the English railroads, as well as to those of nearly every other country on the globe. No one thought four years ago that American bridge builders would go into the open market and successfully compete for the

building of a great steel bridge in Egypt; nor that in so brief a time American engineers would be building railroads into the interior of China from her most important seaports.

At that time no one supposed that the Trans-Siberian Railway would be laid with steel rails made in Pennsylvania, upon crossties from the forests of Oregon, and that its trains would be hauled by American locomotives; nor that this great railway, which is to stretch from St. Petersburg to Vladivostock and Port Arthur, a distance of more than 6,000 miles, would be completed two years in advance of the original expectation, as a result of the use of American construction tools and machinery.

But this is all true, and it is further true that the tools and machinery for the construction of the western portion of the Trans-Siberian Railway were supplied by American manufacturers at about one-half the price that Russia had been paying previously, and with this American machinery the Russians are able to do nearly double the work that they could perform with the machinery manufactured in other countries.

AN EMPIRE EXPRESS IN THE ORIENT.

In a letter from a friend in Tokio, Japan, written only a short time ago, there was this significant sentence: "You will be interested in knowing that I have hanging on the wall of my office a framed picture of your 'Empire State Express,' and we expect in the near future to be hauling a Japanese 'Empire Express' with an American locomotive." They have now in Japan more than one hundred locomotives that were built in the United States. In Russia they have nearly one thousand American locomotives, and practically every railway in Great Britain has ordered locomotives from this country since the beginning of the war with Spain.

In this connection it will be interesting to note in passing that the second American locomotive was built at the West Point Foundry, near Cold Spring, on the Hudson River, and was called the "Best Friend," and from that day to this the locomotive has been one of the best friends of this republic.

OUR SUPERIOR RAILWAY EQUIPMENT.

But it is not alone our locomotives that have attracted the attention of foreigners who have visited our shores; our railway equipment generally has commanded admiration and is now receiving the highest compliment, namely, imitation by many of our sister nations.

Prince Michel Hilkoff, Imperial Minister of Railways of Russia, has, since his visit to the United States a few years ago, constructed a train on much the same lines as the "Limited" trains of the New York Central and the Pennsylvania.

Only a short time ago, at the request of one of the Imperial Commissions of Germany, I sent to Berlin photographs of the interior and exterior of our finest cars and other data in relation to the operation of American railways. Several other countries have asked for similar information, and there is a general waking up of foreign nations on the subject of transportation, brought about mainly by the wonderful achievements of American railways.

The demand for American locomotives from all parts of the world is attributable, in the first place, to the superior quality of our machinery, and in the second place, to the fact that the general passenger agents of the American railways have, through their advertising, made the marvelous results accomplished by our locomotives household words in every country on the globe.

TRADE AND THE FLAG.

It has been said by a great American writer that "Trade follows the flag." Recent events have placed our flag upon the islands of the Pacific, directly in the natural track between the Pacific coast of the United States and Japan and China, and as we contemplate our growing commerce with these old nations, we are reminded of the prophetic statement made at the completion of the first continuous line of railroad between the Atlantic and Pacific Oceans by the joining of the Union and Central Pacific railroads, more than thirty years ago, by that prophet of his time, Thomas H. Benton, who, standing on the summit of the Rocky Mountains and pointing towards the Pacific Ocean, said: "There is the East; there is India."

Previous to the construction of this artery of commerce, the route to India had been by the way of our Atlantic seaports and Europe, but with the completion of our trans-continental system of railways, the route was changed, and a better way was found by way of the Pacific seaports and the Pacific Ocean.

OUR COMMERCE IN THE ORIENT.

There are some who seem to think that we might get along without trade with China, and that it is a new-fangled idea that Chinese trade can especially benefit the United States.

Commerce with China began one hundred and fifteen years ago, the first vessel sailing from New York on Washington's Birthday in the year 1774. This vessel returned to New York May 11, 1775. The success of the venture was such as to warrant its repetition, and from that day to this, trade between the United States and China has continued without material interruption until it is now greater in importance and value than that of any other nation trading with China, with the single exception of Great Britain. If we are to continue as one of the great nations of the world, we can hardly afford to ignore a country that comprises one-twelfth of the land area and nearly one-fourth of the population of the globe.

RAILROADS SUPERSEDE CANALS.

One hundred years ago the Governor of the Great State of New York advised his friends not to invest their money or waste their time in aiding the building of railroads, expressing the opinion that, while it was possible that improved methods of construction and perfected machinery might, in the remote future, enable the people to move a car upon a railroad at the rate of five or six miles per hour, he did not believe that they could ever be made of material advantage, and that any attempt to transport passengers and freight by railroad, from one part of the country to another, must result in endless confusion and loss. The Governor died in the belief that the canal was the only means of conveyance for a great commerce.

DECLINE IN CANAL TRAFFIC.

The greatest number of new boats registered as operating on the canals in a single year was in 1862, when there were 850 new boats. In the year 1897 there were only sixteen new boats registered. You will wonder what has caused the abandonment of several canals in the State of New York and the steady decline in the commerce passing through the Erie Canal.

There are three general causes for these results. The first is the great reduction in the rates of freight by the railroads in the United States, and notably in the State of New York. The second cause is the marvelous development of the motive power and rolling stock of American railways. Less than a quarter of a century ago, upon the average American railroad, the capacity of a freight car was 20,000 pounds; the capacity of a freight engine was from twenty to thirty of such cars to the train.

To-day, on the New York Central, whose six tracks run alongside the Erie Canal for the entire distance from Buffalo to Albany, the capacity of the grain cars is from 60,000 to 66,000 pounds, and a locomotive of the latest type will haul from seventy-five to ninety such cars loaded to their full capacity. It is not an infrequent occurrence for a single engine to haul through the Mohawk Valley, beside the Erie Canal, 85,000 to 90,000 bushels of grain in a single train. The same engine will haul from 110 to 125 empty cars. When you consider that in the busy season there are from seventy-five to 100 such trains a day passing over the New York Central alone, you will get some conception of the situation.

INFLUENCE OF RAILWAY ADVERTISING.

American railway management is always alert and ready to take advantage of every opportunity for extending the commerce of the country, and railway men are among the very first to seize upon each coign of vantage. Within a week from the day that the Paris Peace Commission adjourned, more than one American railway had ordered the re-engraving of its maps to include the West Indies, the Hawaiian Islands and the Philippines. The description of the beauty of our American lakes and valleys, the magnificence of our rivers, the grandeur of our mountains, the fertility of our soil, the wealth of our mineral resources and the superiority of our manufactures, with which our railroad advertising is filled, has been of incalculable value to the export trade of the United States. It has induced thousands of foreigners to visit every section of our country who otherwise would never have come here. It has been the means of the investment in the United States of untold millions of foreign capital. It has been one of the strongest aids to the expansion of American commerce in every direction.

The International Pneumatic Tool Company, Limited, London, England, send us a very neat catalog of their tools, which are the "Little Giant," made in this country by the Standard Pneumatic Tool Company. Various applications of these tools are shown, many of them on locomotive work, and they show some of the possibilities of pneumatic tools in good shape.

The latest catalogue of the Brown & Sharpe Manufacturing Company, Providence, R. I., is devoted to machinists' tools and measuring tools. They have done much to make possible the measurements of to-day, and the catalogue shows many interesting tools. Among them is a measuring machine they use for testing gages, which measures to .00001 of an inch.

We have been favored with a copy of the "Southwest Official Guide," sent by one of our friends who is interested in its publication. It is a very complete guide to that section of the country, giving time tables, hotels, list of towns and their location with reference to large cities, and is altogether a valuable publication for anyone traveling or living in that section. It is a monthly, and costs $2 per year. Address Russell C. Martin, secretary and treasurer, Los Angeles, Cal.

They have a very simple form of smoke-consuming device on the boiler of the stationary plant belonging to the Baltimore & Ohio Southwestern at Cincinnati. It consists of a row of small steam jets that operate through the fire-door and inject a current of air upon the surface of the fire. It works perfectly and no smoke can be seen issuing from the top of the smokestack. There are many steam and heating plants in Cincinnati that are badly in need of this device.

Tight joints in the steam pipe to the air pump is one of the greatest oil-savers on the engine. The little tell-tale drops at a leaky joint speak forcibly of a large waste of oil.

Manly Advice of Manager to Trainmen.

We recently obtained a copy of a letter written by Mr. F. W. Cram, general manager of the Bangor & Aroostook Railroad, to Mr. O. Stewart, the master mechanic, which contains so much sensible advice to trainmen expressed in a manly fashion that we are glad to publish it for the benefit of others. Mr. Cram says:

"In regard to wreck of the steam shovel, etc., it came to my mind repeatedly, before the extra was started, to have the train crew cautioned against any but very low rate of speed, but with the many demands upon me and the semi-feeling I had that any man who could handle a locomotive must know that such a piece of machinery as a set-up steam shovel ought not be hauled faster than 12 to 15 miles an hour, no special caution was sent.

"From such report of the wreck as reaches me, I feel sure the train was on better than passenger train speed. A drawbar may have come out. I believe the shovel or a car first jumped the track.

"The wreck of the wrecking train on the B. & P. a few weeks ago, whatever the immediate cause, developed to a certainty that the speed was excessive and reckless. I believe the engine was being backed; whether so or not, trains derailed on low speed do not spatter all over the country as that one did. The steam shovel train yesterday did not, after derailment, plow through 300 feet of gravel, rocks, rails and ties unless a big run was made for it.

"The recent intimation that enginemen on freights run too fast, coupled with recent occurrences, alarm me not a little; and the more especially because it must be, first, that we have, or ought to have, no engineman who would wilfully damage the company's track or movable property; second, it is morally certain that no one of them wishes to unduly jeopardize the life or limb of fellow workman.

"Granted the correctness of the above premises, and but one conclusion is logically reached; that is, that the men do not realize what they are at times doing. Even though a piece of railroad track may be supposed safe for 40 or 50 miles an hour, so far as engines and enginemen are concerned, it must cost a railroad company at least twice as much to have the freight hauled at 40 miles an hour as at 20; indeed, it is by experts calculated that the increased cost as between 20 and 40 is equal to the square of the increase. Just see what this proposition means—and I believe it is true: Assume the actual cost of hauling a train of freight (twenty-four cars) at about $1 per mile (it is probably slightly more), providing the rate of speed never exceeds 20 miles an hour; that would be, Houlton to Oldtown, $127. Now assume a rate of speed of 40 miles, and you have a cost of $508. Assume an average of 30 miles, and you have $254. Assume an average of 25 miles, and you have $190.50. I believe most sincerely that we have not a single engineer on this road who wants to, or means to, waste $100, or $50, or 5 cents in the hauling of a train. I believe, on the contrary, that if he could be shown how to do it he would, as a rule, see how much he can save on $1 per mile. I have said that railroad men are the most faithful as a class in this country. I have said that the best of the railroad men of this country are in New England. I believe the best in New England are those in the State of Maine. Hence, I affirm that they only need to be brought to a realization of the cost and danger of unnecessarily high speed to stop making it; and it seems to me that you are fully qualified to, and that you can readily have them understand the problem. Won't you please try?

"I presume to any engineman there is no appreciable difference in the riding of the track on Tuesday as compared with Monday, or Wednesday as compared with Tuesday, and so on, and that, at first blush, he might doubt that any great harm is done by 'letting her out once in a while.' Tell him about this, that 'once in a while' is only the beginning; followed up for a time and it becomes only 'once in a while' that he doesn't run too fast. Explain to him that the rails, switches, frogs and other track material on this road represent to-day, in place, a value of, exclusive of bridges, masonry and ballast, nearly or quite three million dollars, and that they are depreciating every minute and worn every trip; explain that much of the ballasting, bridge and culvert repairs, section work, etc., that he sees going on all the time costs less and less under slow than under high speed; that the public demands a prompt passenger service, but that ours is mainly a coarse freight and that it brings us no more revenue and reaches the consignee in as good time for all practical purposes in an eight to ten as in a six-hour run, Houlton to Oldtown, for instance; explain that if rails, etc., up to the value of three million dollars can be made to average twenty years in life, the depreciation is but $150,000 per year; if they are pounded out in fifteen years the depreciation is $200,000 per year, and that he, by unnecessary speed, may waste, absolutely throw away, the $50,000 per year. Your engineers will see—I know they will see—this. They know now that while they come to see no great danger of derailment from high speed, that if there *is* a derailment the damage is immensely greater than under low speed, and that the chance of injury to, or death of, their fellow workmen is tremendously increased.

"When it comes to any but the most moderate speed with ordinary work trains, or such movement of company material, as with the wreck train from Abbot Pit, or the shovel train yesterday, it is difficult to imagine how any man can find a reason for 'speeding' over a single foot of the road.

"I could dwell very much in detail upon the reasons offered for high speed after something has happened, or more likely sometimes a claim that the train was being moved cautiously, but I have no doubt these points are as clear in your mind as in my own. I recall the statement of one man that to 'make time' he 'had to run fast.' My observation, extending over a considerable period, shows me that when a freight (upon which the high speed is said to be necessary) crosses a passenger train, at a place like Sherman for instance, where one can see a long way, the latter has sometimes made its stop and start and is several miles on its journey before there is any sign that the freight has gotten away. It would be a simple matter for the freight conductor to arrange for a newspaper to be thrown off by the passenger train baggage master; or, if there were any chatting to do, to make a memo. and hand it to whoever it is for; but do the boys appreciate that the ten minutes lost is the very ten minutes that would let them go at 20 miles an hour instead of 30? A minute to a mile is the whole point under discussion. It is due that I say in this connection that as a rule enginemen are at their posts in such cases, and I have no doubt that if they received the signal they would be away before the passenger train has made its stop and started.

"I could multiply illustrations of this kind, but will not. If you can get my, which I am sure are your, views clearly before the enginemen, they will be sure to go before the other train men, and I believe all will try to meet our wishes.

"It is because I believe so fully in our men, because the record is so good, because the recent accidents disturb me so much, because I believe it also disturbs the boys, who are my friends, and whose friend I am, that I write so fully and so earnestly. We are all working here together; the harmony and the sympathy one with the other seems to be exceptional. I am proud of it, and lose no opportunity to give all praise and credit to my associate officers and subordinates. The public know us all as 'railroad men.' We know each other as fellow workers. What helps one, helps all; what hurts one, hurts all. Nothing in this world hurts me more than to know that one of my men is hurt. It hurts the road, its owners, its officers, its men and me every time an accident happens or a dollar is wasted."

[We do not think Mr. Cram's calculations about the cost of increased train speed to be approximately correct; but most of the remarks about high speed of freight trains are sensible and sound railroad philosophy.—Ed]

In the cartoons published during the past political campaign the American workman has been a prominent figure, and he is always portrayed carrying a well-filled dinner bucket, a broad smile and a square paper cap. We have always been curious to know where the artists found the man with the square-cornered cap. We have been much among workmen, but we never yet met a man wearing that kind of a cap.

The Reeves Machine Company, Trenton, N. J., send us one of their new catalogues, showing the Harthan metallic packing, which we illustrated last month. It gives the reasons for its success, and is sure to interest anyone using or handling packing for piston rods or valve stems. It is worth sending for.

The Ajax Metal Company, of Philadelphia, have issued a catalogue showing the products of this company and giving much information about white metals in railroad service. These are compared with the Ajax metal and the showing made is very favorable to it. There are photo-micrographs which show the perfect mixing of the metals, and altogether it is a very interesting publication.

Jenkins Bros., of 71 John street, New York, have sent us a description of the Collis circulating valve for radiators and heating coils, which they are now handling. It is not a new or untried device, but has the sanction of some of the leading heating engineers. With only one valve to a radiator a perfect circulation of dry steam is insured. This enables heating surfaces to be warmed more quickly and effectively, and the annoying hammering of pipes is avoided. Better look into this.

The new catalogue of the Gold Car Heating Company, Frankfort and Cliff streets, New York, is a fine large, cloth-bound book of about eighty pages. Full-sized cuts of the well-known hose couplings are shown on large inserts. The Gold pressure regulator is shown in detail, as well as the car-heating systems which are becoming so widely known. There are too many specialties shown to enumerate them all, but they are all of interest to car men and those responsible for keeping passengers comfortable in the cold weather.

We have received applications lately from several railroad motive-power men to illustrate inventions they had gotten out, so that the patent shark should not cover them with patents and collect royalty from the inventors. This has actually been done repeatedly. A convenient or labor-saving device has been got out in some railroad shop and put into service without being considered worthy of protection. The patent-stealing thief sees it, swears it is his invention, and then the original inventor has not only lost the product of his ingenuity, but has to pay the thief a premium on the dishonest transaction.

Armored Trains.

The British army seems to be making more use of armored trains in Africa than ever was done before, but they cannot be declared a shining success. Armored trains were used to some extent during the Civil War in this country, but the results obtained did not encourage the combatants to extend that line of military enterprise. In a recent issue of the *Railway Herald*, of London, a good summary of what has been lately done with armored trains reads:

"The subject for the week is armored trains. Our readers may not be aware that ever since the invention of the locomotive, strategists have been puzzling their heads as to the possible use of trains, not simply for purposes of transport, but as an active instrument of war. Jules Verne, in one of his books, describes an iron elephant which dealt death to mutineers in India.

"But the real inventor of the armored train appears to be Mr. James Anderson, of Edinburgh, who, in 1847, submitted plans of defensive rolling stock. In 1849 he suggested that a million of money should be expended on the construction of a single line railway along the south coast, 100 miles in length and connecting with other railways. This would be his area for manœuvring. But the Duke of Wellington did not quite see it. The gun truck was 12 feet in breadth and 21 feet in length. It was heavily ballasted, so as to be able to meet the recoil of the 32-pounder. The total weight of the truck was about 20 tons.

"Armored trains were frequently used in the Franco-German war. The French, in their sorties from Paris, used to be backed up by light cannon mounted in this way.

"Against Arabi, Captain Fisher's armor-clad train was used with considerable effect. The locomotive was placed in the middle of the train, a Nordenfelt machine gun occupied the front vehicle and a 40-pounder the next. The latter could be mounted and remounted by means of a small crane, one minute's halting of the train being sufficient to fire the gun.

"In England an armored train has been used with considerable effect—in mimic warfare. The Sussex Artillery Volunteers had some 300 men and a 40-pound breech-loading gun to spare. The idea struck them to fit out a train. The Brighton line gave the use of their workshops and the benefit of technical advice. In this case the recoil is so admirably neutralized by a hydraulic brake on the gun's own carriage, as well as by rising slides on which the wheels of the latter rest, that the permanent way is entirely undisturbed by the concussion. A stone placed on the metals is not upset. Probably, however, the steel mantlet on this train is too high. It would afford a good target, and also a fine bursting shield for shells.

"This brings us to the South African armored trains, where the narrow gage will necessitate the most careful consideration of questions of stability. The first blood drawn in the war has been shed in the attempt to capture or defend such a train. Nothing could exceed the gallantry, we might almost say the audacity, of Captain Nesbitt, who literally ran his train into the jaws of death. We do not yet know exactly what occurred, save this, that the Boers did not approach the derailed train until after five hours' bombardment, and only then because daylight had revealed flags of truce. The driver of the pilot engine escaped into the sluit and crawled along his stomach for a mile and a half to safety. The rest of the train's complement are in the hands of the Boers."

A practice has been inaugurated by the mechanical department of the Union Pacific of planing all mud rings for locomotive fireboxes inside and out. They are all double riveted, and great pains taken to do the work in first-class shape. The engines that have been treated in this way show entire freedom from the nuisance of leaky mud rings and corners.

There is an opinion cherished by a great many railroad motive power men that they could build much better engines than those purchased from contract shops, if only the company would provide them with the necessary tools. They might build a better engine, but it would cost more, as those who have gone into the experiment well know. In connection with the question of the relative value of contract work and that done in the railroad shops, we recently heard of a curious discovery made by the mechanical department of the Union Pacific. This was that a firebox put in by the builder of an engine could be depended upon to last several years longer than one made in the railroad shops. The cause for this could not be explained, but it is a fact.

The first number of the "Official Messenger" of the International Correspondence Schools of Scranton, Pa., has reached us, and is a very interesting publication. This number is devoted to showing the school, its teachers and methods, and cannot fail to attract those interested in educational subjects. Portraits of the founder, Mr. T. J. Foster; of the president, Mr. Rufus J. Foster; of our friends, Cosgrove and Rolfe, of the Locomotive Department, and a host of others, including the first student, serve to enliven the book, and as we always like to know what people look like, this seems to make us acquainted with the whole school. Future issues will contain helpful articles on practical subjects, and are sure to be interesting. We understand these are for free distribution, and they are certainly worth sending for.

Holy Writ on Free Railroad Passes.

Quite a long time ago a minister of the gospel wrote Mr. William B. Strong, who was then a high official of the Michigan Central Railroad, requesting an annual pass over that system. The minister was duly supplied with a half-fare permit. This did not appease his desire, however, and he immediately instituted a more diligent pursuit of the coveted annual by writing Mr. Strong as follows:

"Dear Sir—You sent me a few days since a *half-fare permit*, which, please, *fully permit* me to thank you for. As a proof that I should be given the annual pass I requested, I respectfully call your attention to the following passages of Scripture:

"Exodus vi. 10—'With a *strong* hand shalt thou let them go.'

"II. Chronicles xvi. 9—'Strong in be-*half* of them.' (Half in this case means, not the half I now have, but the other half of the permit, so that I shall have a full free pass for the year.)

"I Kings ii. 2—'Be *strong* and show thyself a man.'

"Jeremiah xv. 14—'I will cause thee to pass.'

"Ezekiel xx. 37—'I will cause thee to pass.'

"Ezekiel xxxvii. 2—'And caused me to pass.'

"Joshua xxii. 19—'Then pass over.'

"If the above passages do not find or reach some responsive chord in your bosom, other language will, of course, utterly fail to impress you."

Mr. Strong replied as follows:

"It is an old experience that the Scriptures can be made to sustain any doctrine or dogma if it be ingeniously applied. I thought I was complying strictly with the most liberal offers of transportation to be found in the Bible.

"Early in the history of the Jews we find the account of their emigration from Egypt, and certainly going in such numbers they would be entitled to as low a rate of fare as could consistently be asked or granted by anyone, yet in the 13th verse of the 30th chapter of Exodus I find the following: 'This they shall give—every one that *passeth—a half*.' If this does not cover the case, I know not where to look for authorities.

"In one of your citations you refer to what you are pleased to call 'other half of the permit which I sent you. I fear that it would be of little service, since our conductors, being better versed in mathematics than theology, would be sure to collect full fare from anyone traveling on two half-fare permits.

"But to convince you that I look to Holy Writ as an authority for declining free passes, permit me to quote a few precepts on the subject of passenger transportation which I find in its pages, beginning with such as seem especially addressed to the passenger:

"I. Kings xx. 39—'Thou shalt pay.'

"II. Kings iv. 8—'Go and pay.'

"Ecclesiastes v. 4—'Defer not to pay.'

"Exodus xxi. 18—'He shall pay.'

"Exodus xxi. 26—'He shall surely pay.'

"Jonah i. 3—'So he paid the fare and went.'

"In addition to these precepts to the passenger, I find the following injunctions to the railroad manager:

"Judges iii. 28—'Suffer not a man to pass.'

"Nahum i. 15—'The wicked shall no more pass.'

"Isaiah xxiv. 10—'None shall ever pass.'

"Jeremiah li. 42—'Though they roar, yet shall they not pass.'

"Perhaps after this array of Scripture authority I shall not be justified in sending you the annual desired, yet I find my sympathies stronger than my theology, and take pleasure in sending you herewith the pass requested."

Map Sheet of Two Wars.

These are times when a correct understanding of the most prominent news of the day requires frequent study of a map. The news has penetrated regions to which the general geographer had not gone and which no ordinary atlas shows in sufficient detail to enable one to follow the movements of armies. One will look in vain on the maps of last year for such places as Elandslaagte, Glencoe, Colenso, Belmont, etc., in South Africa, and for Aliaga, Talavera, Magalang, Mabalacat and Lingayen in the Philippines. Yet these and similar little points in two distant quarters of the world have become news centers. The need of the hour is met by a folded map sheet which the Matthews-Northrup Company, of Buffalo, have published for the Buffalo Express and for general distribution. One can be obtained for 10 cents.

At a recent meeting of the Western Railway Club a smoke inspector connected with the Board of Health of Chicago delivered an address upon the smoke nuisance and urged railroad companies to renewed efforts in preventing locomotives from polluting the air with black smoke. We supposed from this gentleman's remarks that the stationary steam boilers in Chicago had ceased to paint the sky black with their inky smoke. Some of the Chicago furnaces were notorious for this. On a recent visit we could not see that the least improvement had been effected. We stood on a high building for half an hour. In all directions there seemed to be a competition going on among large and small chimneys, to see which would spew out the thickest volume of smoke. No wonder that a dense cloud of smoke hangs over Chicago like a pall of mourning.

Another Record Breaking Train.

A London paper called the *Daily Mail* must have very enterprising managers, for they lately conceived the idea of delivering their paper in Manchester, 206 miles away, before breakfast. The Great Central Railway Company undertook to run a light train at tremendously high speed, and the "War Express," as it is called, is now running regularly every morning except Sunday. The company intimate that the newest locomotives recently built by our friend, Mr. Harry Pollit, locomotive superintendent, are used, with a light train, at a speed of 80 miles an hour. The run on the first day was made in 3 hours and 28 minutes, which is close on 60 miles an hour. The run was begun under unusual difficulties. An English paper describing the run, says:

"For the first forty miles or so out of London the nature of the road, even under the best conditions, was not conducive to great speed. With a fog like a blanket, and with a slippery track to make things worse, there was no attempt at the sensational. So we just 'dodged along,' as Ned Grain [the engine driver] afterwards put it, at about 35 to 40 miles an hour until the Great Central main line was reached.

"Then there is a rush—a roar; and the stoker, Fred France—an amiable fire-fiend—shoots his head into the blackness on the left side of the engine, and yells 'Right away!' and Mr. Grain jigs the regulator a trifle towards himself, while he grips the brake with fingers of steel.

"No. 268 is obviously getting into her stride, for, like a living, feeling thing, she leaps to the touch and tears screaming through the choking, blinding fog.

"The enthusiastic amateur who was seated on the footplate sorts himself out from a heap of fuel into which he has been hurled by the infuriated No. 268, and begins to freeze on one side and roast to what feels like a rich brown on the other.

"Such trifles as these, however, do not count for much now. The engine-driver is still edging that lever towards him, and the wild thing upon wheels is pounding and thundering forward, half, it seems, in the air and half on the track, at a speed of 77 miles an hour. The cheek of the amateur in the corner-seat is now unhealthily red, and his heart is thumping in perfect rhythm with the engine. There is a shame-faced inclination to say, 'Please, Mr. Grain, don't meddle with that handle any more; you may break something,' but it never comes to utterance, for with one mad sidelong plunge No. 268 crashes round a curve, and almost paralyzes the brain with hideous racket.

"As for the landscape, what is there to see? Nothing but walls of impenetrable fog, out of which, at rare intervals, peeps a tree, flashing past like some gaunt, filmy spectre.

"Through the wrack of driving fog and steam, still gripping the brake, still with his strong face set steadily to the freezing night, the fine old driver is dimly visible. Then he eases down for Leicester.

"Plenty of willing hands are there to take over the consignment of *Daily Mails*, and in a few minutes the 'War Express' is gathering speed again for the run of 23 miles to Nottingham.

"This section, covered while a dreadful night is at its worst, is concluded in the amazing time of 17 minutes, which at a precise calculation gives an average speed of 81 1-6 miles per hour.

"During most of that awful 17 minutes it seemed obvious that the *Daily Mail* 'War Express' had somehow climbed outside the earth and was frantically rushing over the crust of it and falling through space, while thousands of goblins thrust their grinning faces out of the fog and leered horribly at a phantom engine-driver.

"But such weird fancies are dispelled as the cheery lights of Nottingham gleam ahead, and presently the porters are hastily handling their great bundles of *Daily Mails*.

"Again No. 268 is turned loose on the track for the final stages of a memorable trip, but after the severe nerve-test experienced on the Leicester to Nottingham section, the fact that No. 268 is frisking along at 70 to 75 miles an hour becomes commonplace, and your blasé correspondent actually yawns in a bored way when the amiable stoker yells into his ear that the short, sharp noise as of a hammer stroke on the engine was caused by the train shooting through half a mile of tunnel.

"Sheffield is reached well ahead of time, and the crowning coup of a remarkable morning is made as we steam easily into the London road terminus at Manchester 26 minutes in advance of schedule time.

"From the crowd already assembled on the platform there is a chorus of congratulations, while the work of providing Manchester with its breakfast *Daily Mail* is hurried to a conclusion."

Announcement is made of the organization of the New York Air-Compressor Company under the laws of the State of New Jersey. The capital stock of the company is $100,000, and a complete foundry and machine-shop plant has been purchased on the line of the New York & Greenwood Lake Railroad at Arlington, N. J. Contracts have already been let for a full modern equipment of tools. It is intended to manufacture a complete line of air-compressing machinery at the new plant. The officers of the company are: J. W. Duntley, president; Alexander MacKay, vice-president; W. P. Pressinger, secretary and treasurer. The directors are: J. W. Duntley, Alexander MacKay, W. P. Pressinger, William B. Albright, W. O. Duntley, Thomas Aldcorn and Austin E. Pressinger. The New York offices of the company are at 120 Liberty street.

Pushers for the Delaware & Hudson Canal Co.

The Schenectady Locomotive Works have turned out six heavy consolidation pushing engines for the Delaware & Hudson Canal Company. They are similar to those we illustrated in the August issue on page 349, except that they are larger. The cylinders are 22 x 28, the weight on drivers 157,500 pounds, and total weight 176,000 pounds.

The total weight was limited, and it was desired to get as much heating and grate surface as possible within the limits. The rods are of light channel section. Driving axles have enlarged wheel fits. Frames are cast steel. The grate surface is 90.19 square feet and the heating surface 3,348 square feet. This is believed to be the largest heating surface ever applied to a locomotive of this weight.

Railroad companies who are inclined to send out their foremen occasionally to visit other shops for the purpose of gleaning new ideas, might make the Union Pacific shops at Omaha the objective point of the pilgrimage with advantage to all concerned. There are lots of ideas flying loose about these shops.

The Baltimore & Ohio Southwestern Railroad people have applied electric motors to moving the turntables at their principal engine houses. Mr. A. G. Phillipps, roundhouse foreman at Cincinnati, is very enthusiastic about the merits of the use of electricity in moving the turntable. The wipers and shop laborers never have to leave their work to push at the turntable. One man who attends to the pits does all the work in handling the turntable. The motive power for this turntable is exceedingly simple, and consists of a small motor which turns a gear wheel secured on the shaft of the turntable wheel that moves on the circular rail in the turntable pit. The weight of the engine on the table gives the traction wheel sufficient adhesion.

One of the great attractions to railroad men of the International Exposition to be held in Paris next year will be the congress relating to railroad matters. This congress begins on September 15, and takes in nearly all living subjects regarding railroads of the present day. Locomotives and rolling stock will receive a great deal of attention, and we think that the records of that congress will be one of the most interesting publications ever gotten out. The leaders of the congress invite railroad men to send in papers and information regarding the business they are connected with, and we gladly urge that those having anything worthy of publication should send particulars to the secretary of the Belgian legation at Brussels, Belgium.

One of the best equipped tool rooms for a railroad shop that we have ever examined is that belonging to the Missouri Pacific Railroad at St. Louis. The room is in charge of Mr. Roebbel, a wonderfully ingenious inventor and skillful mechanic. His delight seems to be in making exact measuring instruments and in devising box tools and formers that will perform complex finishing at one operation. He has a vernier gage of his own make which is a work of art. There is in this room a complete set of test gages used for keeping up ordinary measuring gages to accurate dimensions. Constant vigilance with the use of these is what maintains interchangeability of parts.

The Chicago & Eastern Illinois Railroad Company gave the engineers and firemen in the freight service a surprise last month by advancing wages voluntarily. The wages of the engineers on the big freight engines were increased from $3.85 per 100 miles to $4, and those of the firemen from $2.25 to $2.40. On the smaller engines the engineers will receive $3.85 instead of $3.75, and the firemen $2.20 instead of $2.10. General Superintendent Broughton said: "The increase has been decided upon on account of the general prosperity of business, which has resulted in the increase of the earnings of the company, and because of a desire on the part of the company to advance the rate of pay when the earnings will warrant it, and with a view of acknowledging the satisfactory service on the part of the men in handling the traffic."

The American School of Correspondence, of Boston, Mass., has been very successful with locomotive runners and firemen by means of its up-to-date system of instruction by correspondence. The locomotive runner's course begins with the simplest mathematics, and the student is gradually advanced to more difficult subjects, such as Designing of Boilers and Engines, Operation and Construction of Air Brakes, etc. The courses of this school are limited strictly to steam, electrical and mechanical engineering, and as they have been prepared by well-known educators and experts, they are complete, accurate and thoroughly abreast of the times. The student's work is carefully inspected by the instructors of the school, who are all graduates of the leading scientific schools. The school has been warmly endorsed by many of the leading educators and engineers throughout the country. It is chartered by the Commonwealth of Massachusetts, and as its chief aim is to benefit the ambitious workman, the tuition is placed very low in order that every mechanic may secure the technical knowledge necessary for advancement in his profession. All engineers and firemen interested in improving their technical education should send for a catalogue.

CONTENTS.

INDEX TO ADVERTISEMENTS.

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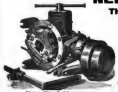

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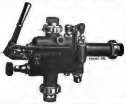

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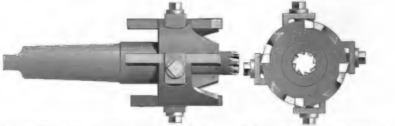

The Cutter illustrated herewith is especially adapted to the rapid and economical production of holes in metal plates such as flue sheets for locomotive and other boilers, structural or bridge work, etc., and its tool holder is designed for the express purpose of receiving **rough bar tool steel,** which latter require no machine-work whatever, it being necessary to grind them only at their cutting ends.

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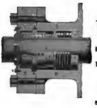

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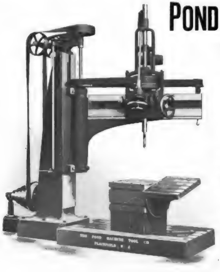

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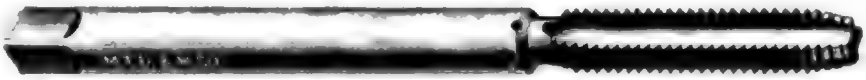

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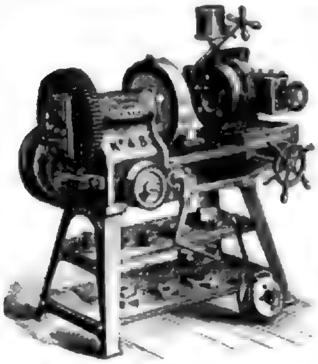

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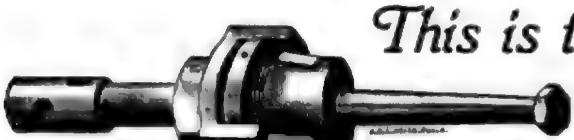

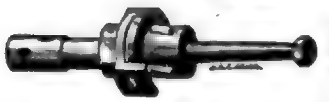

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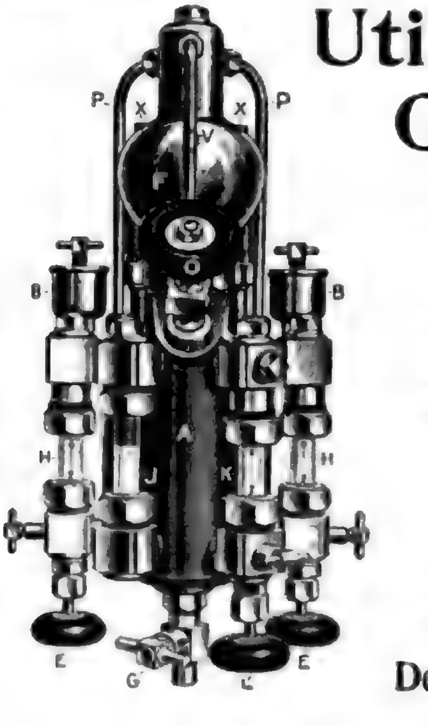

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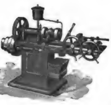

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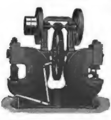

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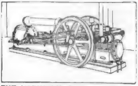

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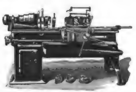

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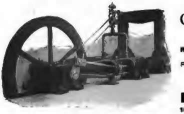

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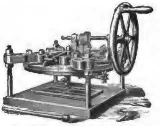

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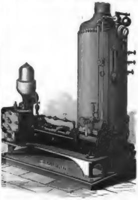

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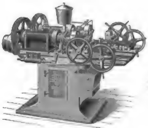

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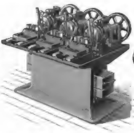

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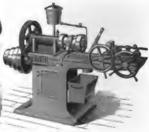

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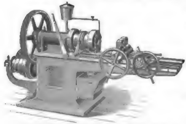

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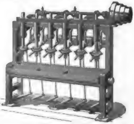

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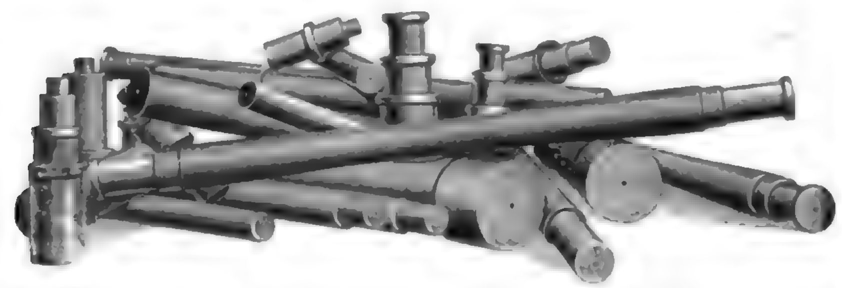

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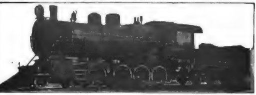

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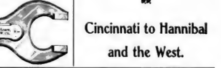

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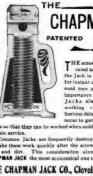

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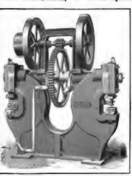

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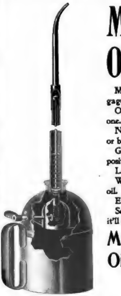

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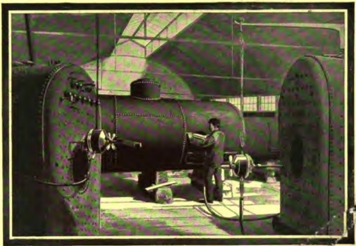

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